American Machinist / Metalworking Manufacturing

A McGRAW-HILL Publication • Seventy-Five Cents

SEPTEMBER 19, 1960

CHICAGO SHOW REPORT

16 pages starting on 109

New ablative plastic nose cone for Atlas — production details on page 95

GUIDE TO PRODUCTION CONTROL

Special Report, page 125

Did you see Heald's NEW Model 171A Internal?

It's **LOADED** with new features for better production and easier servicing!

1. **Cross-slide Wheelhead Feed** assures maximum freedom from distortion under heavy roughing cuts—feeds faster and more accurately, with better size control.
2. **Right-Hand Feed Box** provides either constant feed or impulse feed that advances the wheel only at reversals of the table. Gives better finish and straightness on long bores. Manual override permits operator to fast feed or retract at any time.
3. **Infinitely Variable Compensation** for wheel wear, from 0 to .004", contributes to more constant size and longer wheel life.
4. **Front-Adjusted Wheel Dresser** is easier and safer to operate.
5. **Hydraulic Workhead Drive** provides greater range of speeds (from 50 to 1350 rpm) at the turn of a knob.
6. **Machine Base Contains No Heat-Producing Equipment** —hydraulic power and lube oil units are externally mounted, preventing thermal distortion and permitting easier access for servicing. Variable-displacement hydraulic system pumps oil only when it is *needed* to operate a cylinder or motor.
7. **Hydraulic and Electrical Cabinet** contains all hydraulic and electrical control mechanisms in separate dust-tight compartments—everything is easier to get at. Faster-acting miniature d-c solenoid valves speed-up cycles, last longer.
8. **Large Cabinet-Type Guards** cover entire work area and open automatically for greater safety, better coolant control and easier access for fixture changeover.

Heald Model 171A Internal Grinders are available in Size-Matic, Gage-Matic or Plain models for work with up to 8" swing and angular capacity up to 90°.

Ask your Heald engineer for complete information, or send for your copy of Bulletin No. 2-171A-1.

CIRCLE 151 READER SERVICE CARD

It PAYS to come to Heald

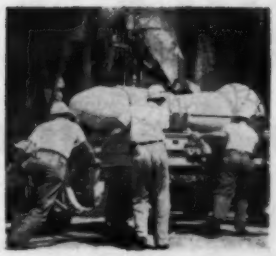
THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • Milwaukee • New York • Philadelphia • Syracuse

HEALD

COVER:
Plastic nose cone for the stainless steel Atlas missile is wheeled into position at the launching pad. Production details on page 95.



American Machinist / *Metalworking Manufacturing*

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METALWORKING REPORT

Chicago Exposition Edition

CUTTING

Tougher Graphite for EDM

High-density graphite that can be machined without the usual flaking and chipping is a development about to be announced by several companies. The tougher material can be cut to contours required in electrodes for electrical-discharge machining, to replace conventional brass.

As electrodes, the graphite allows discharge-cutting rates two to three times as high as brass, with the same finish on the work. These results are with EDM equipment fitted with vacuum-tube power supplies, standard on US machines.

Wheel Dresses Wheel

To form the sides and radii of large grinding wheels in such applications as crankshaft grinding, Landis Tool Co has developed a diamond-impregnated dressing wheel about 2½ in. in diameter. It is driven independently at 1700 rpm by its own electric motor.

This system improves on the conventional single-point diamond wheel dresser by improving control of the exact wheel shape, especially on a radius and the flat sides of the wheel. The dressing operation is also faster.

Powered Chipbreaker Improves Turning

Higher cutting efficiency, better chip break-up, and smoother single-point-turned finishes are claimed for an oscillating-chipbreaker toolholder developed by Cleveland Hobbing & Machine Co. The toolblock mounts on any lathe and clamps a standard tool.

An electrically powered transducer in the toolholder oscillates the tool as it cuts, with dial-adjustment control over the size of chips produced. The tool tip wipes the work, taking off the usual continuous tool mark and breaking the chip. The company calls it "cleaving action," and says power requirements can be cut 50% and tool life improved 50%. Tool pressure is said to be lower, and one of the implications is that a lighter lathe can do the work that normally requires a heavier machine.

Comparison tests show sharp differences in the chips when the unit is turned on, then off, with the same tool cutting the same work. Chips are said to be several hundred degrees cooler with the transducer working.

Gearcutting — Higher Hobbing Speeds

Big gears can now be hobbed at cutting speeds approaching those normally applied on smaller gears with a friction-drive flywheel hob head developed by Lees-Bradner Co. The unit increases inertia in the tooth-cutting system, reduces vibration, and provides greater capacity. This results in improved finishes on the work and in better cutter life.

The head is now installed on a new 12-in. heavy-duty hobbing machine especially designed for cutting large, coarse-pitch gears. Hob speed control works through a range of 100 to 400 rpm.

Openside N/C Boring Machine

Work can be positioned anywhere within a 15-by-6-ft table area on American Tool Works' numerically controlled, 19-in.-column, openside boring and drilling machine. Specifically designed to cut machining costs on extra-large work, the machine can also be set up for a number of smaller jobs positioned along the length of the bed. (Here the work can be set up in one or more areas while parts are being machined in others.)

A General Electric numerical-control system positions the saddle and head, but both can also be positioned through a keyboard mounted alongside the head. To coordinate the tape to the workpiece location, zero shift control for the tape system is provided for the entire work area.

Traverse of the drillhead on its arm ("Y" axis) is 80 in., of the saddle on the bed ("X" axis) is 180 in., and of the arm on the column is 50 in. Travel of the spindle is 18 in.

Oil-Float Headstock

Precision cylindrical grinding—to tolerances of ±15 millionths—is possible with a new No. 2 universal grinder developed by Brown & Sharpe. Key to this high degree of accuracy is a hydrostatic headstock in which the spindle floats in high-pressure oil.

If the spindle deflects even slightly during an operation, the oil is controlled automatically to compensate for pressure changes, and the spindle is forced back to center. The equalizing hydraulic system works fast, during heavy cuts, and keeps the spindle effectively on exact center even though the cut or load changes.

FORMING

Thread Roller Straightens Shafts

Long cylinder holddown studs for a current compact-car engine are being straightened at 80/minute without marking the work on a Landis Lanhyrol thread roller equipped with rollers that have helical ribs. The parts run out some 0.06 to 0.07 in., and even as much as 0.100 in. in some cases. After straightening, they are true within 0.010 in. tir. Pressure applied is 20,000 lb, which overbends the work, relieving stresses, and also removing heat-treating scale. The machine is standard, and can be changed back to thread rolling by inserting new tools.

Faster Aluminum Can Line

Aluminum beer cans are being extruded 66 percent faster than any current rate by a Verson 400-ton horizontal extrusion press. Cans are 2⅝ in. in diameter and 4½ in. long.

With a blank feeder, trimmer, and flanger, the press will be installed to approximate the output of a conventional steel-can line. Cost of the aluminum can is expected to be com-

parable with steel, and the equipment will cost less than that for a steel-can line.

A 75-hp motor drives the press crankshaft and flywheel. Extrusion pressure on the waxed aluminum blanks is 35-75 tons a square inch. Dies are hardened to Rh 60-62C.

Precision Blanks

Hot and cold chipless machining methods are due to make early inroads on conventional machining practice for automotive parts. Impact extrusion studies being made by Verson All-Steel Press Co on differential side gears, starter gears, and other automotive parts indicate that some parts can be produced without cutting them from barstock.

With impact extrusion, blanks can be made ready for final machining on chucking machines and grinders. Teeth must still be cut in gear blanks; but overall costs are less than if the parts were cold extruded.

In hot forming, torsion bars, drive shafts, and axles can be produced in such equipment as the Hill-Acme automatic forging machine, which gathers metal from a small-diameter bar to make a headed shape at five times the speed of hand-fed machines. Such parts can go directly into a grinder.

Dual-Equalized Press Brake

Throwing its hat in the hydraulic-press-brake ring at the Machine Tool Exposition, NATCO claims it has a machine that would operate satisfactorily even with one of the hydraulic cylinders disconnected. Capacity would be reduced 50 percent, but the ram would stay in alignment, because it has both mechanical and hydraulic equalization.

The mechanical equalization is provided by a heavy tube that runs across the top of the machine and is based on the crankshaft principle. It's mounted in bearings at each end so it can rotate through a partial arc, and it's also connected to the ram at each end by a turnbuckle-type arm. Therefore, when one side of the ram goes down, the other side has to go with it.

With an electric foot pedal, the operator has complete control of the ram from inching to full cycle. The press brakes are offered in a line ranging from 200 to 500 tons and handling sheet widths from 10 to 14 ft.

COMING IN AM/MM
OCTOBER 3

Detroit's New Compacts;

How Buick builds small V-8's, Olds machines underwater, and Pontiac makes transaxles & shafts

THE OUTLOOK:

The expected fall pickup in metalworking production and new orders has still failed to materialize. Most industries are now setting their sights on mid-October as the date when the summer doldrums will end. *(See p 89)*

INSPECTION

Fast Check for Sheet Hardness

Steel sheets at Ingersoll Steel Div, Borg-Warner, are now checked by one man at high speed with a Rockwell tester set up beside a roller conveyor. The man slides the edge of the sheet under the anvil of the semi-automatic testing unit and gets a reading from a dial.

This simple setup works in place of the old method where two men had to cut small test samples from the sheets and carry them to a bench tester. Result: the model R tester has paid for itself in 5 months.

Trend to Transistors

In electronic gaging, use of transistors (instead of vacuum tubes) should increase greatly in the near future. One gage manufacturer, Federal Products Corp, will shortly bring out a precision comparator with a completely transistorized amplifier.

Transistors and gages are made for each other, the company points out, for several reasons. More reliable than vacuum tubes, they need less power, take up much less space, and produce almost no heat. This low heat output is especially important in comparator amplifiers, which must be turned on hours ahead (if vacuum tubes are used) to stabilize sufficiently for accurate measurements; with transistors, there is no waiting period. And because they simplify gage construction, transistors give the buyer more for his dollar. Federal's new comparator will sell for less than half what its vacuum-tube predecessor cost.

Federal Products also will use transistors in three other new instruments: (1) in an air-electric control gage that automatically controls finish size on plunge-cut grinders; (2) in the signal unit of automatic gages, to amplify the gage signal and provide switching action for feedback control, classification, and sorting; and (3) in the amplifier of a high-precision master comparator.

WELDING

Arc Spotwelding for Aluminum

"Many immediate applications" are envisaged by S E McFall of Aluminum Laboratories, Ltd, who says that gas metal-arc spotwelding will be a useful tool in joining aluminum, especially in the transport and architectural fields. In transport applications, the button of weld metal on the sheet looks like a rivet. In architectural work—welding hangers to the back of panels—the weld leaves a barely perceptible mark on the front.

Operating procedures and test results are described in a paper he will present to the AWS National Fall Meeting in Pittsburgh next week. For most of the experimental work, the bottom sheet was AA—6061 and the top AA—3003, anodized and unanodized. Procedures cover top-sheet thicknesses of 0.040 to 0.125 in. Ideally, the bottom sheet should be twice as thick as the top, but suitable results are also obtained at one and at three times top-sheet thickness.

In general, shear strengths are comparable with resistance spotwelding strengths. Cleaning requirements, however, are not as strict as for resistance spotwelding; normal degreasing will do it. Best power source is dc, with a flat or rising characteristic.

FINISHING

Navy Deposits Tungsten

National Bureau of Standards has perfected a vapor-depositing method for the Navy by which tungsten can be plated onto complex contours—such as missile parts that need structural strength at 2000 C. The work has to be heated to 1200 F in a hydrogen atmosphere, held in a ceramic

cylinder. The tungsten deposits with high purity—even better than obtained by powder metallurgy or flame spraying. Thickness of the coating can be controlled up to 1/16 in., taking an hour.

Hydrogen and tungsten hexafluoride is fed into the chamber; the tungsten deposits, and the residual hydrogen fluoride is absorbed in a trap. Flow rate of the mixture has little effect, but the proportions should be 6 parts of hydrogen to one of tungsten hexafluoride to insure smooth deposit.

MATERIALS & COMPONENTS

Gas Servo for Tough Service

Inert gas powers a fast, accurate servo developed by GE's aircraft-turbine department for difficult service such as high-temperature, radiation, or hazardous atmospheres. It was designed to position reactor-control devices where conventional servos break down. One possible application is in machine tools.

It works on a proportional system with infinitely-adjustable stroke with positioning accuracy better than 0.5% of full stroke. It responds to command signals at speeds up to 20 cycles/second.

Bearings for Repeatability

Bearings of all kinds and in all applications are undergoing close scrutiny because of the developing requirement for repeatability—not necessarily absolute accuracy—in machines of many types. Air-film bearings are finding more applications—a new one is in lifting a heavy machine tailstock so it can be easily and accurately shifted during a machine cycle.

In other applications (such as work supports) leaf springs or reeds replace hardened and ground bearings. With known flexure, a leaf spring has close positioning repeatability, offers good bearing contact and requires little or no lubrication.

For other applications, especially in automatically controlled machines, the trend is almost entirely to preloaded ball-sleeve or roller-contact bearings.

MATERIALS HANDLING

Efficient Hoist

A lightweight hoist that can lift a heavy load has been built for the Air Force to handle ICBM's for underground launching. It weighs a ton, but can lift 50 tons.

It operates by means of two remote-controlled telescoping cylinders, each 35 ft long when extended, which raise the missile from its transporting vehicle and lower it to the launching pad. Hoist builder is the Pacific div of Bendix Corp.

MANUFACTURING CONTROL

Long-Distance Tell-Tale

Gardner grinders are equipped each with a row of four-inch-square panels on top of the control cabinet which light up to illustrate current operating condition of the machine. This allows a foreman standing down a row of machines to tell how each machine is operating at a glance.

Some display panels indicate normal conditions such as load, wheel dress, grinding, and so on. Others indicate abnormal conditions such as excessive load, coolant off, and parts out of gage limits.

The indicators, actually installed for display purposes at the Machine Tool Show, are optional equipment.

BORING

N/C Changes Hole Sizes

A double-end precision boring mill by Ex-Cell-O has Rheem numerical control over all operating motions, positioning the work so holes can be finished at several locations—and one more function: N/C also controls the shift of slide-mounted boring tools, which can be indexed off center to cut holes of any required diameter.

A test part being shown has several through holes and several blind holes, of several diameters, all completed in one machine setup with automatic tool shift to change the effective diameter of the boring tool.

Tool shift is made after a previous hole has been completely bored to required diameter. The N/C system operates an accurately positioning boring-tool slide that has crossways motion on the tool spindle.

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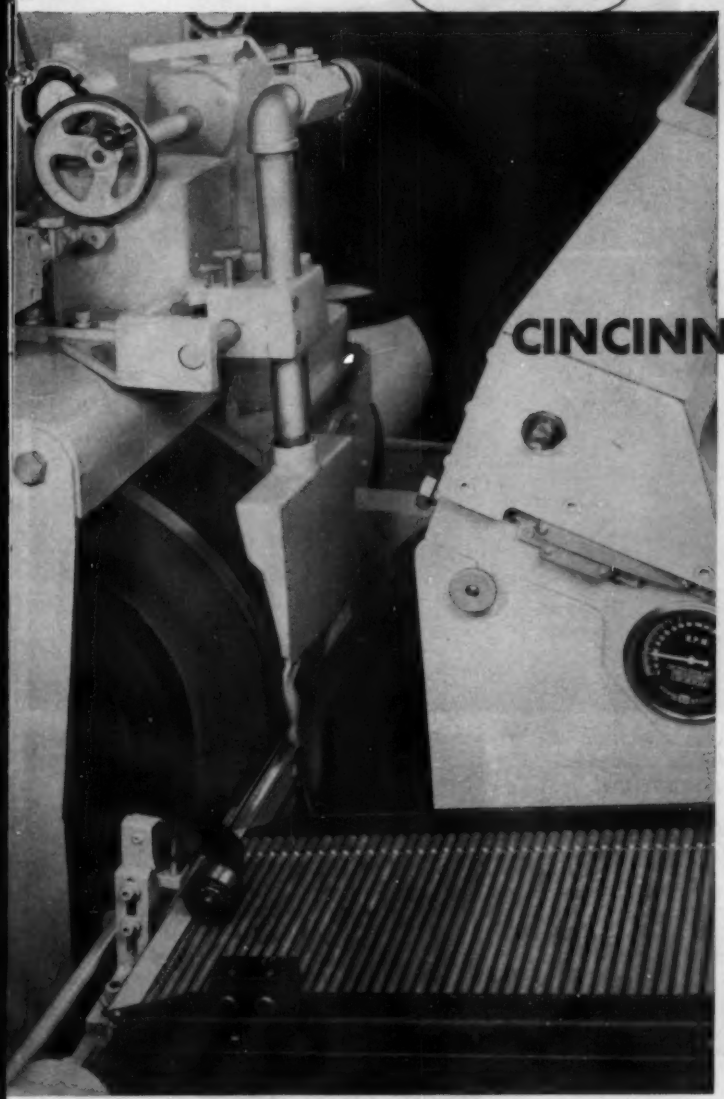
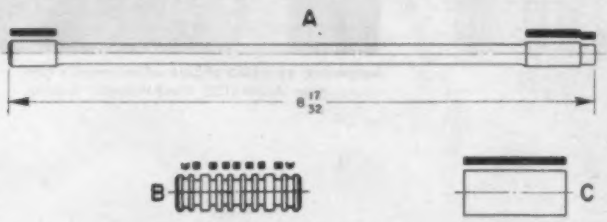
Exposition revealed many benefits...

MMT-PE



Grinding three diameters at the ends of shafts 8½" long (part A). CINCINNATI No. 220-8 Centuramic Centerless Grinding Machine is tooled up with automatic work handling for this operation.



Three ideas in low cost centerless grinding were revealed by the setups to grind the parts illustrated above.

Immediate
cost-reducing possibilities
available through...

CINCINNATI'S New Centerless Grinding Machines and ideas

New ideas... new machines... new ways to reduce costs were evident everywhere at the Machine Tool Exposition. In the bustling crowds, perhaps you did not have time to ponder the possibilities offered by three fine Centerless Grinders which were included in Cincinnati's extensive exhibit. The operations which they were performing are illustrated at the left.

Smallest of the Cincinnati line, the No. 107-4, was tooled up with crush truing equipment to grind grooves from the solid in ½" diam. spools (part B). Electro-hydraulic automatic infeed and automatic loading maintain a uniformly high rate of production for work of this type.

The No. 220-8 Centuramic, a 20 hp machine, demonstrated a setup having wide application. Diameters at the ends of a shaft 8½" long (part A) were ground to accurate size and exactly in line with each other.

The No. 340-20 Centuramic Centerless, powered by a 40 hp spindle drive motor, ground short steel pins (part C), removing .007" stock in two passes at the fast thrufeed rate of 15 ft. per min.

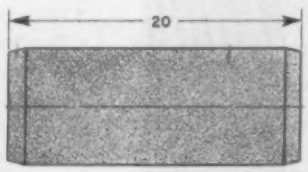
CINCINNATI Centerless Grinders, coupled with 38 years of centerless engineering service, are outstanding candidates for your immediate and future cost-reduction program. May we give you more information? One profitable replacement possibility offered by the heavy duty No. 340-20 machine will be found on the two pages following. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

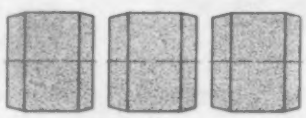
CINCINNATI

GRINDING MACHINE DIVISION

PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

New CINCINNATI FILMATIC No. 340-20 Centuramic, with 20" wide wheel. Powered by a 40 hp spindle drive motor, this Centuramic removes .007" stock in two passes at the fast thrufeed rate of 15 ft. per min. Details in catalog G-727D.





One 20" wide wheel Centuramic exceeds the thrufeed production potential of three 6" wide wheel machines . . . because nearly 60% more abrasive per minute contacts the work!

Automatic guardian of size—Cincinnati's new trend type ACRASIZE Post-Process Gaging.

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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CINCINNATI FILMATIC

One replaces three-

Cincinnati No. 340-20 Centuramic Centerless cuts 6 thrufeed passes to 2

PRECISION GRINDING TRUISM: reducing the number of passes sharply reduces the cost of thrufeed centerless ground work. There are two ways to reach this desirable end result. 1) The risky way, by reducing grinding stock to the danger point of inviting scrap. 2) The safe and sure way, by wide wheel thrufeed grinding on a CINCINNATI No. 340-20 Centuramic Centerless. This fine new machine makes heavy grinding stock disappear quickly. That's because the wheels are 20" wide, and wide wheels can remove more stock per pass than narrow wheels. Of course, the entire machine, from the bed casting to the FILMATIC spindle bearings, is constructed to take advantage of the heavy duty potential of extra wide wheels. And the FILMATIC spindle bearings perform equally well under the dual requirements for heavy stock removal and light-as-a-whisper finishing passes.

Cincinnati attachments and accessories reduce costs still further. One of the newest is ACRASIZE Post-Process Gaging. It automatically gages the parts as they leave the grinding throat, and adjusts for variations in size.

You will find complete information on heavy duty CINCINNATI Centuramic Centerless Grinders in catalog G-727D. Ask for a copy today.

• ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI®
GRINDING MACHINE DIVISION

CIRCLE 156 READER SERVICE CARD

Actual Size

now you can check & record fine-pitch gear accuracy

at 1600 magnifications

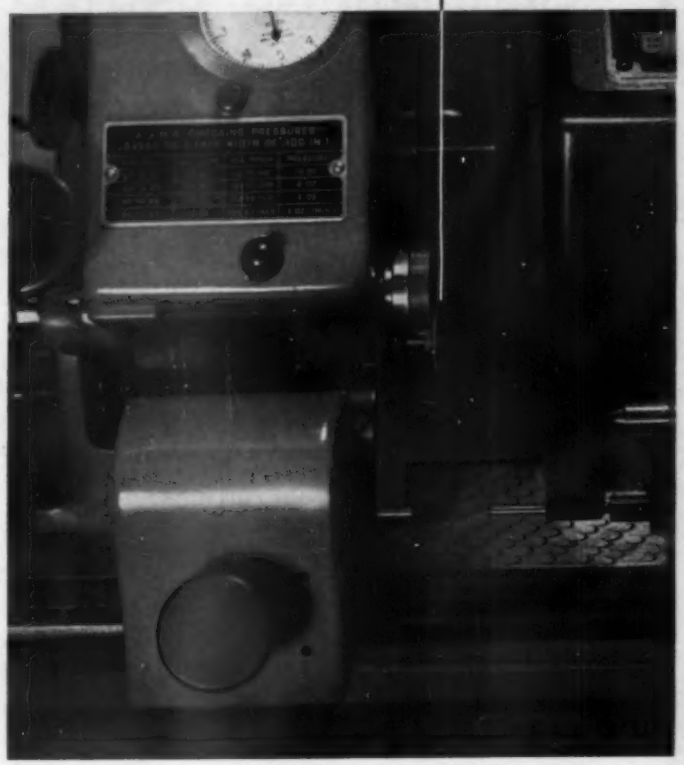
on the No. 4 Fellows Red Liner

Now, the No. 4 Red Liner makes "composite" checks on the finest instrument gears with unbelievable accuracy and sensitivity. 1600 to 1 magnifications are obtained with the electrical recording system which gives a written, unbiased record for instant reading or for proof-of-accuracy files.

One report states — "11 teeth, 200 D. P. pinion backed up to a 100 tooth gear on a cluster, checked easily on the No. 4 Red Liner."

The job shown is 96 pitch with 22 teeth on the small gear and 80 teeth on the larger gear. The pinion shaft rides in vees in a turret-type fixture.

Fellows inspection units cover a range from the tiniest instrument gear up to some that are 24 inches in diameter.



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Investigate the full line of [illegible] *inspection equipment*

No. 4 Fine-Pitch Red Liner

No. 8M Red Liner

No. 20M Red Liner

No. 12H Lead Measuring

No. 12M Involute Measuring

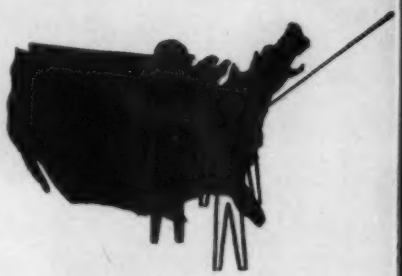
THE PRECISION LINE

Fellows *Gear Production Equipment*

There is a Threading Specialist IN YOUR SHOP

He is your Landis Service Representative. Although not in your plant every minute of every day, a phone call or wire will bring him to you promptly. Down time, improper chaser life, failure to meet specifications . . . these are the types of problems your Landis Service Man helps you to avoid.

These Service Representatives, located throughout the country, can help you in many ways. For example, they can show you how to best use your threading equipment (whether the operation is by cutting, grinding, tapping, or rolling) to save you time and money. They will aid in translating the general sales literature data into specific information on producing your particular threading job. They can describe the special equipment that has been designed for threading unusual and difficult-to-handle workpieces. By working with our Engineering Department, they are able to provide additional information on similar equipment for your special threading requirements. These are but a few of the many ways the Landis Service Representative can help you.



All LANDIS Equipment is guaranteed to produce threads to meet the degree of accuracy and production for which it is sold. Our extensive staff of Service Men, plus the above guarantee, emphasize the value LANDIS assigns to satisfied customers. We sell performance, not just products, and you become an expert on threading, when our experienced Service Representatives are at your service.

LANDIS *Machine* COMPANY WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines

Die Heads—Rotary & Stationary

Taps—Collapsible & Solid Adjustable

Centerless Thread Grinding Machines

Thread Rolling Tools

Thread Rolling Machines

541

Now...grind with *predictable*

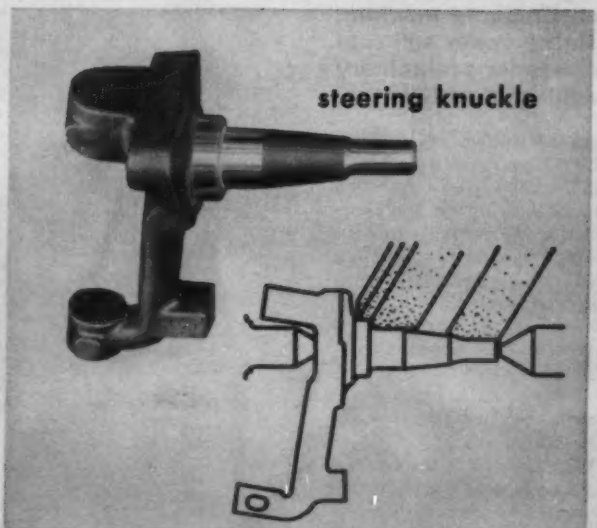
New Landis automatic plunge grinder gives

precision and production
consistent accuracy and higher output

Field reports of actual production figures

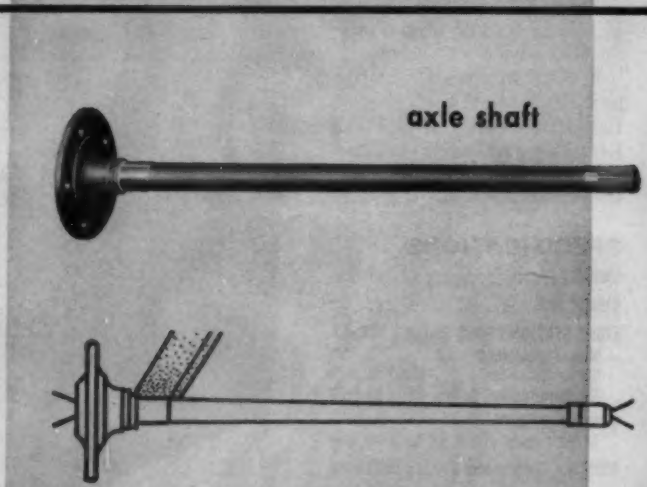
57% savings in cost per piece over former method

Part.....steering knuckle
Net production.....210 parts per hour for 2 machines—1 operator
Operation....grinding two diameters, radii and face surface at one time
Machine.....Landis R Plunge Grinders
Material.....5147 chromium steel forging
Stock removal.....015"-.018"
Finish .....Commerical
Specified tolerances....size.....0006"
roundness...0002"
straightness .0002"



cost per piece cut 58% from former methods

Part.....axle shaft
Net Production.....240 parts per hour for 2 machines—1 operator
Operation..grinding two bearings, adjacent face and radius at one time
Machine.....two Landis R Plunge Grinders, one operator
Material.....5147 chromium steel forging
Hardness.....Rockwell 50-52
Stock removal.....015"-.020"
Finish.....Commercial
Specified tolerances....size.....0006"
roundness...0002"
straightness .0002"



LANDIS
precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

NEW Warner & Swasey

AS A PRECISION CHUCKING TURRET LATHE...

It is a heavy duty precision finishing machine with the power and ruggedness for preliminary roughing operations, too!

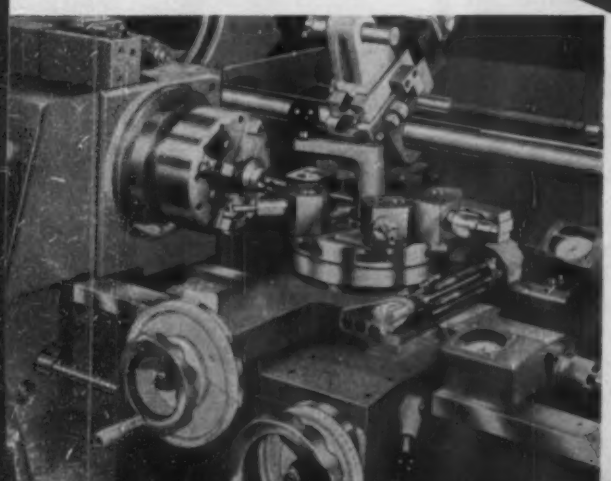
Warner & Swasey's New No. 2 MICRO-CUT Precision Chucking Turret Lathe combines into one machine the individual metal removal capabilities of first operation roughing machines and second operation precision finishing machines. As a result, more work pieces can be machined complete in a single chucking—job scheduling is simplified—concentricity tolerances are held easily.

With the No. 2 MICRO-CUT you can handle a wide range of small, complex, close tolerance work pieces in all materials—and do it on a production basis.

For full information on the new No. 2 MICRO-CUT Turret Lathes call your W/S Field Engineer, or write to The Warner & Swasey Company, Cleveland 3, Ohio.

SPECIFICATIONS

SWING ..... 14" Dia.
CHUCK DIA. ..... 6"
EIGHT STATION CROSS SLIDING TURRET
Max. cross travel ..... 5"
Six cross feeds ..... .0007 to .008
Six longitudinal feeds, .0015 to .017
SPINDLE SPEEDS
Three ranges of six, 50 to 3000 rpm
MOTOR—Two speed ..... 5/2½ hp

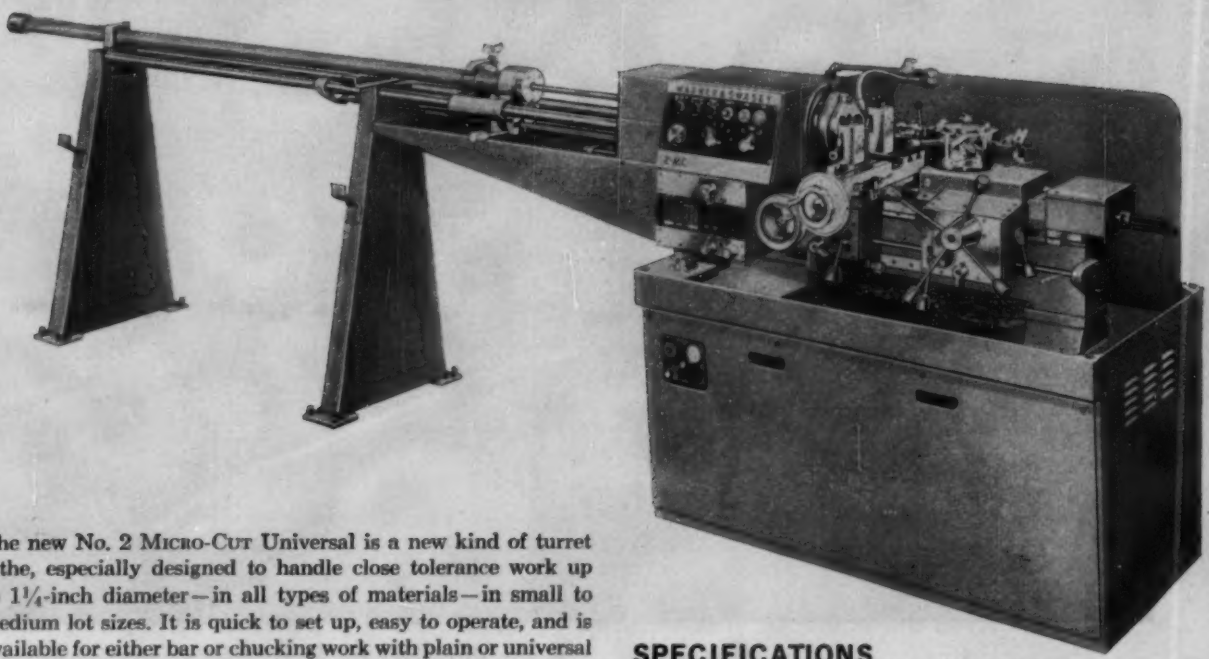


EIGHT-STATION CROSS SLIDING TURRET features a new Curvic Coupling mounting for the ultimate in precision alignment and rigidity under cut. Power feed pressures are uniquely adjustable for extra accurate, automatic "knock-off" in both cross and longitudinal direction. Tangential "T" slots for mounting turret tooling reduces setup time.

No. 2 MICRO-CUT

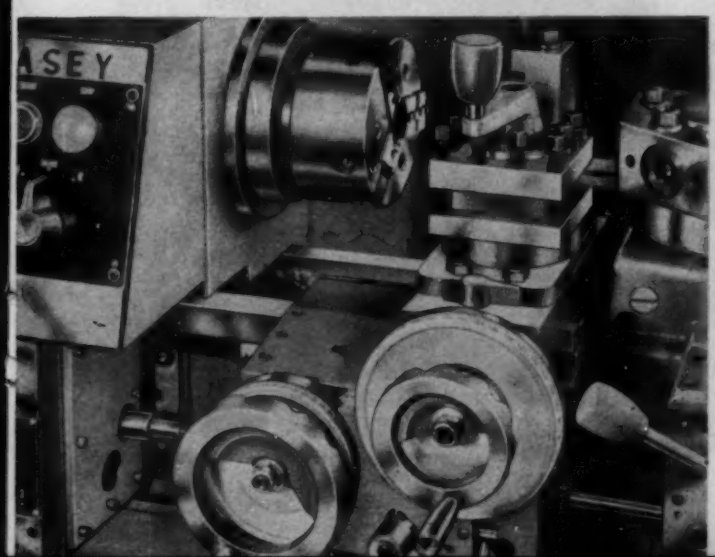
AS A UNIVERSAL TURRET LATHE...

It is the first 1¼" capacity turret lathe with full universal, power feed cross slide plus greater accuracy and heavier metal removal capabilities.



The new No. 2 MICRO-CUT Universal is a new kind of turret lathe, especially designed to handle close tolerance work up to 1¼-inch diameter—in all types of materials—in small to medium lot sizes. It is quick to set up, easy to operate, and is available for either bar or chucking work with plain or universal cross slide. The No. 2 MICRO-CUT is ideally suited to handle a wide variety of small diameter turning work in those fields where extreme accuracy, even with heavy metal removal, is essential to profitable operations.

To get the complete story on the new No. 2 MICRO-CUT Universal Turret Lathe call your W/S Field Engineer, or write direct to The Warner & Swasey Co., Cleveland 3, Ohio.



SPECIFICATIONS

SWING —	Over bed	14" Dia.
	Over cross slide	6" Dia.
BAR CAPACITY —	Round	1¼"
	Square	⅞"
	Hexagon	1⅛"
CHUCK DIAMETER		6"
POWER FEEDS		
	Six longitudinal	.0015 to .0173
	Six cross	.0014 to .016
SPINDLE SPEEDS		
	Three ranges of six	50 to 3000 rpm
MOTOR —	Two Speed	5/2½ hp

UNIVERSAL CROSS SLIDE AND THREE JAW CHUCK. The No. 2 MICRO-CUT Universal cross slide, with square turret featuring a curvic coupling locating and locking mechanism, has power feed in both cross and longitudinal directions. Feeding pressures are uniquely adjustable through three ranges—from a "heavy" setting for rough cuts to a "light" setting for extremely accurate, automatic knock-off of precision finishing cuts.

Two and three-jaw, hand or air operated chucks are available for holding small castings, forgings and bar stock slugs.

You can produce it better, faster, for less...with a

WARNER & SWASEY

CIRCLE 164 READER SERVICE CARD

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it

New numerically-controlled turret lathe shatters idle time . . . is ideal for short runs

At the last Machine Tool Exposition, five years ago, Jones & Lamson exhibited an automatic tape-controlled turret lathe. It created a sensation and attracted thousands of fascinated spectators. Many of them wanted to buy. But the machine wasn't for sale. Why? Because there were still "bugs" in it to be ironed out, and our reputation is too valuable to risk on an "almost" product.

In the five years since, J & L still kept this lathe off the market, pending its complete development and proving-out. Now, it is ready to be shown, ready to be sold, ready to help you attain new production efficiency.

The new J & L numerically-controlled turret lathe is a complete redesign job. The sound features of the early prototype have been retained, and all question marks have been eliminated. In every way, this is a real beauty!

It's designed especially for short run production and top economy. It has the capacity of a No. 5 machine, 2¼ x 24 in., and has three turrets (one hexagon and two square) which accept up to 14 preset tools. A set of tools plus the tape can be "packaged", ready for set-up when needed.

This lathe can be set up as either a bar machine or a chucker, in 10 to 15 min. It positions within .001″, repeats to .0005″. Drive motor is 30 HP, with spindle speeds of 40 to 2000 rpm in 24 steps. Feed rates for carriage and saddle are .750″ to 30.0″ per minute in 16 steps, plus fast motion. Cross-slide operates at one-half these rates. Tape input information may be adjusted for extended tool life and size control by manual dials on the control panel. Productivity is increased 25 to 30% over standard cycle time. Even the automatic bar feed is programmed from the tape. See it at Chicago, or write for advance information now. Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

Landis Abrasive No. 618 surface grinders at Speedring Corporation, Warren, Michigan

Speedring reports surface grinding missile components to 15 millionths using electronic gauging

Finish grinding missile components on a Landis Abrasive No. 618 shown with electronic gauge and master block for checking height.

Landis Abrasive No. 618 surface grinders are top choice at Speedring for grinding missile components and gyro parts. They report that the table and spindle accuracies required to grind pure beryllium, beryllium oxides, ceramics, ferrites and many other exotic metals in their plant are rigidly controlled on these Landis Abrasive surface grinders.

LANDIS
ABRASIVE
precision surface grinders

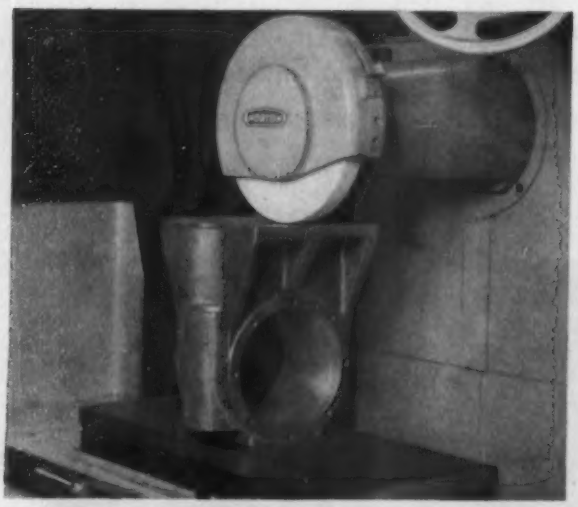
Landis Tool Company, Waynesboro, Penna.

A big success...so...

Bringing Top Performance to Larger Jobs

New additions to the newer larger Type S-3 grinder include: (1) *Bigger Work Table*, with work surface 8" wide, 24" long; (2) *Interlocking Cross-Feed Hand Wheel*; (3) *Power Cross-Feed*; (4) *Cross-Feed Stop Dogs*. The many job-proved features, *for improving your profits*, include: (5) *Two-Speed, .0001" Increment Hand Wheel* assuring accurate vertical feed and fast positioning; (6) *Contoured Splash Guards* providing better sighting and loading.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



High-Grind Wheel Head Construction, provides 13¾" vertical capacity from table top to bottom of standard 10" diameter grinding wheel, for handling tall workpieces.

150 Feet Per Minute is the Type S-3's high table speed that enables you to produce smoother plane surfaces, cut grinding time and increase production rate.

we're building it bigger!

Norton Type S-3 surface grinder... with proved ability to finish flat faster... Now available in 8"x24" size

Performance of the new Norton 6" x 18" Type S-3 surface grinder for customers like these . . . Addressograph-Multigraph Corporation, Clevite Corporation, Cleveland Graphite Bronze Division, National Cash Register Company, The Timken Roller Bearing Company, Warner & Swasey Company . . . has made this larger size a necessity.

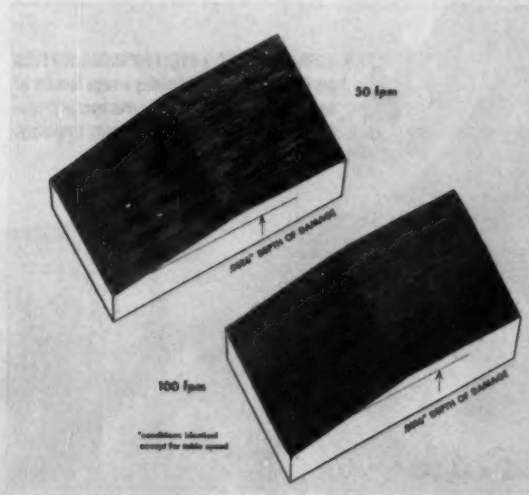
Besides a longer and wider work table, other design advancements enable this top-ranking surface grinder to finish bigger workpieces smoother, faster, at lower cost. Get the whole story from your Norton Sales Engineer, a trained specialist who can help you get better grinds for less money, or ask for our catalog 1982. NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

NORTON

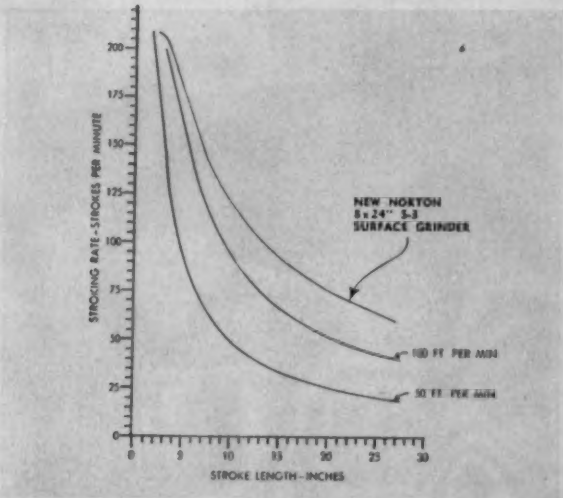
MACHINE TOOLS

75 years of... **Making better products ...to make your products better**

MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners



Better Quality Work due to less heat damage with faster table speeds . . . at the same time greatly increasing the rate of stock removal.



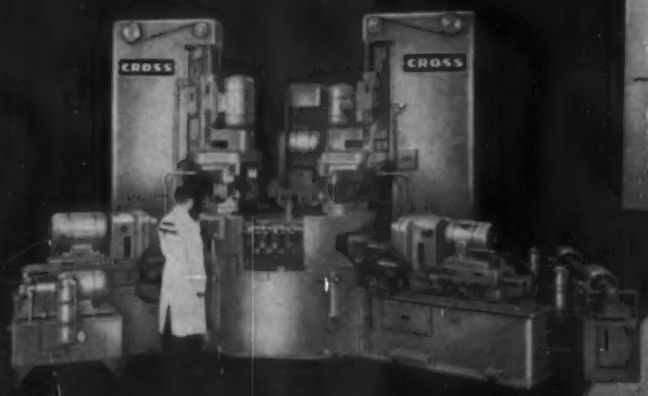
Calculate Your Savings from this Production Rate Chart. Grinding time is reduced in proportion to the increase in stroking rate.

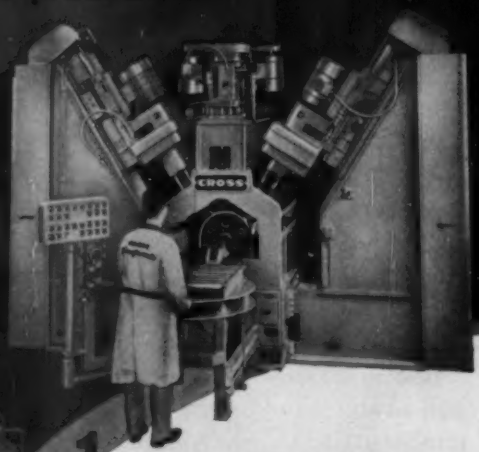
CIRCLE 168 READER SERVICE CARD

CIRCLE 169 READER SERVICE CARD ►

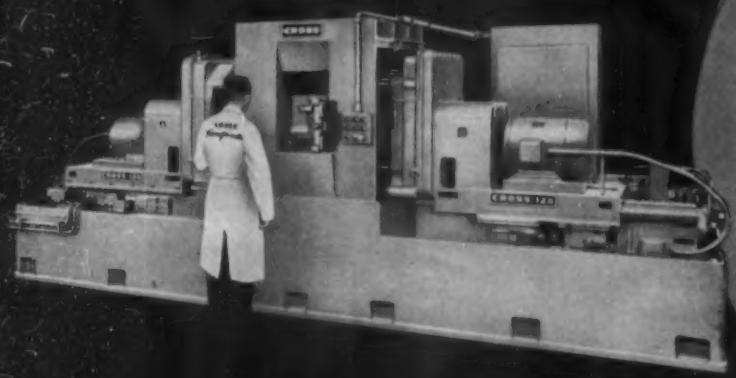
6 ways to automate

Cross automation takes many forms . . . from the simplest low production machines to complex equipment for mass production.





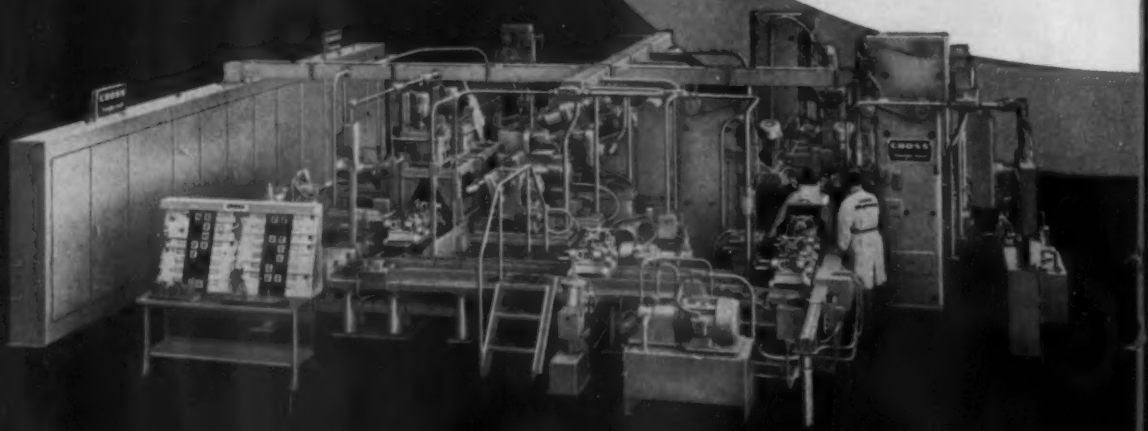
1 **CROSS SINGLE STATION MACHINES** exist in many configurations to combine operations.



2 **CROSS DIAL TYPE MACHINES** provide multiple station performance with minimum floor space.

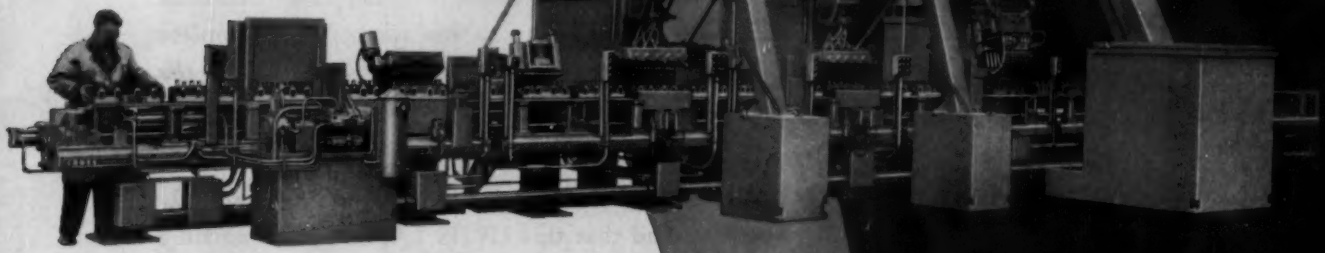
3 **CROSS TRUNNION TYPE MACHINES** are compact multiple station units that permit operations on opposite sides of the part.

4 **CROSS PALLET TYPE TRANSFER-MATICS** provide capacity for combining a large number of operations. Standard pallet fixtures handle irregularly shaped parts with maximum flexibility.



CROSS ASSEMBLY TRANSFER-MATICS open up new fields to reduce costs in assembly operations.

6



The six machine types illustrated here were created by Cross to apply the principles of automation to a wide variety of metalworking operations. Thus, Cross makes available the benefits of automation to small or large manufacturers, regardless of required production volume.

Cross sales engineers are available to discuss your automation problems with you. They will also be glad to discuss the new Cross Process Development Service created to solve *unusual* automation problems—in or out of the metalworking field.

CROSS SECTIONIZED TRANSFER-MATICS provide a means of combining unlimited numbers of operations. Automatic in-process work storage minimizes downtime and increases operating efficiency.

5

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

High production broaching of lightweight metals is the purpose of this extremely versatile machine, which is solving many problems where light tonnage and long strokes can be combined.

A noted American rifle manufacturer, for example, is Lapointe-Broaching the extractor pictured here, at the amazing production rate of 194 complete parts per hour — *with no further machining operations required on the broached surfaces.* Operation is fully automatic, including ejection of broached parts.

To lower your own production costs, while at the same time substantially improving your quality, you may find that this UVHS LAPOINTE Broaching Machine (or one of the others in our extensive series) can work miracles for you. Why not find out? An experienced Lapointe Field Engineer will gladly call on you, on request.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

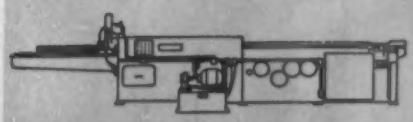
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Are you making
PRECISION GUN PARTS?...MISSILE COMPONENTS?

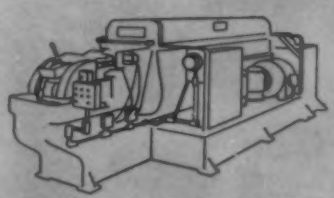
If so, you should investigate this

uvhs LAPOINTE fully automatic **BROACHING MACHINE**

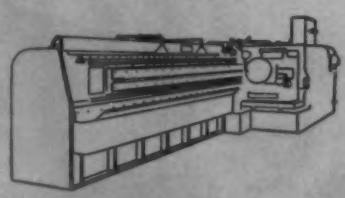
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



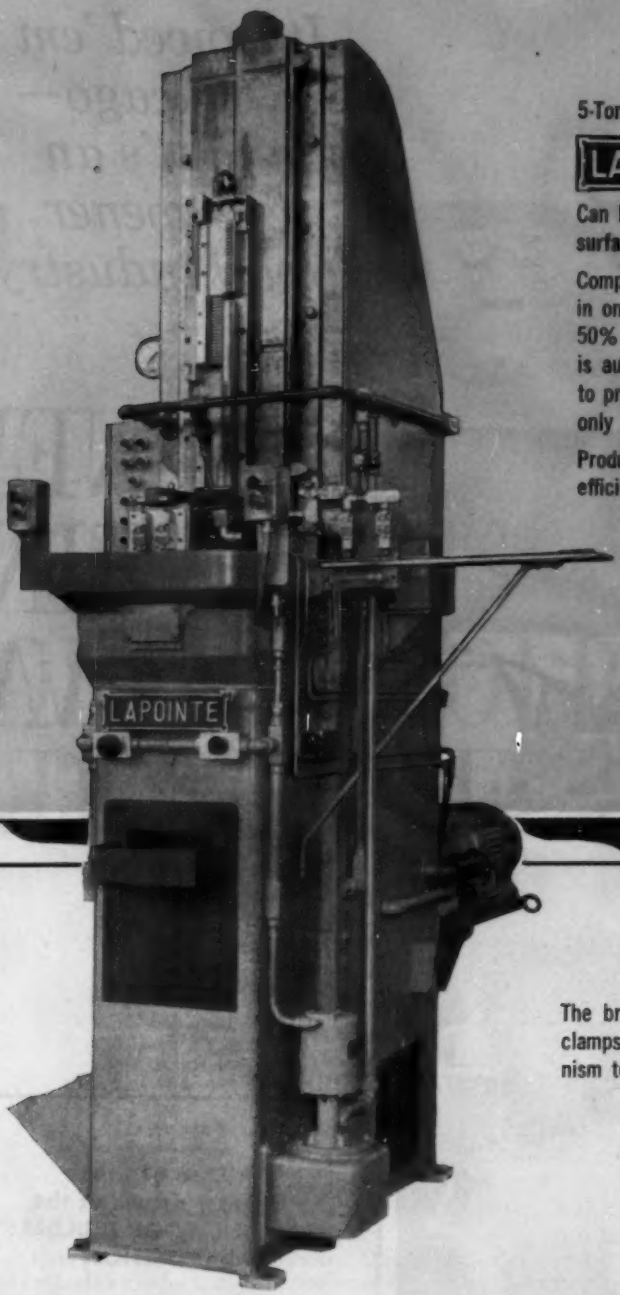
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC



5-Ton, 54-inch Stroke

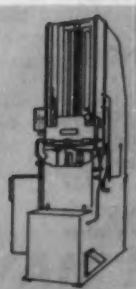
LAPOINTE Universal, Vertical, Hydraulic Single Ram BROACHING MACHINE

Can be adapted for **internal broaching** as well as **surface broaching.** (And it's priced **right.**)

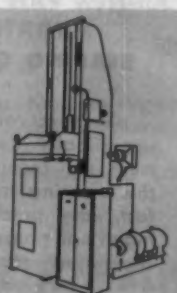
Complete contour of the rifle extractor is broached in one pass, with stock removal approximately 50% of starting bar size. Steel bar stock .145" x .232" is automatically fed, clamped, broached and cut off to proper length of part. Length of stock is governed only by available space.

Production is 194 parts per hour, at 100% efficiency, using 22 f.p.m. broaching speed.

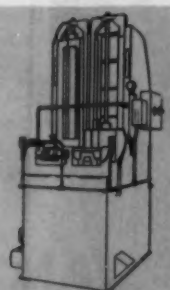
The broaching fixture has hydraulically operated clamps and hydraulically operated feed mechanism to accommodate strip bar stock.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

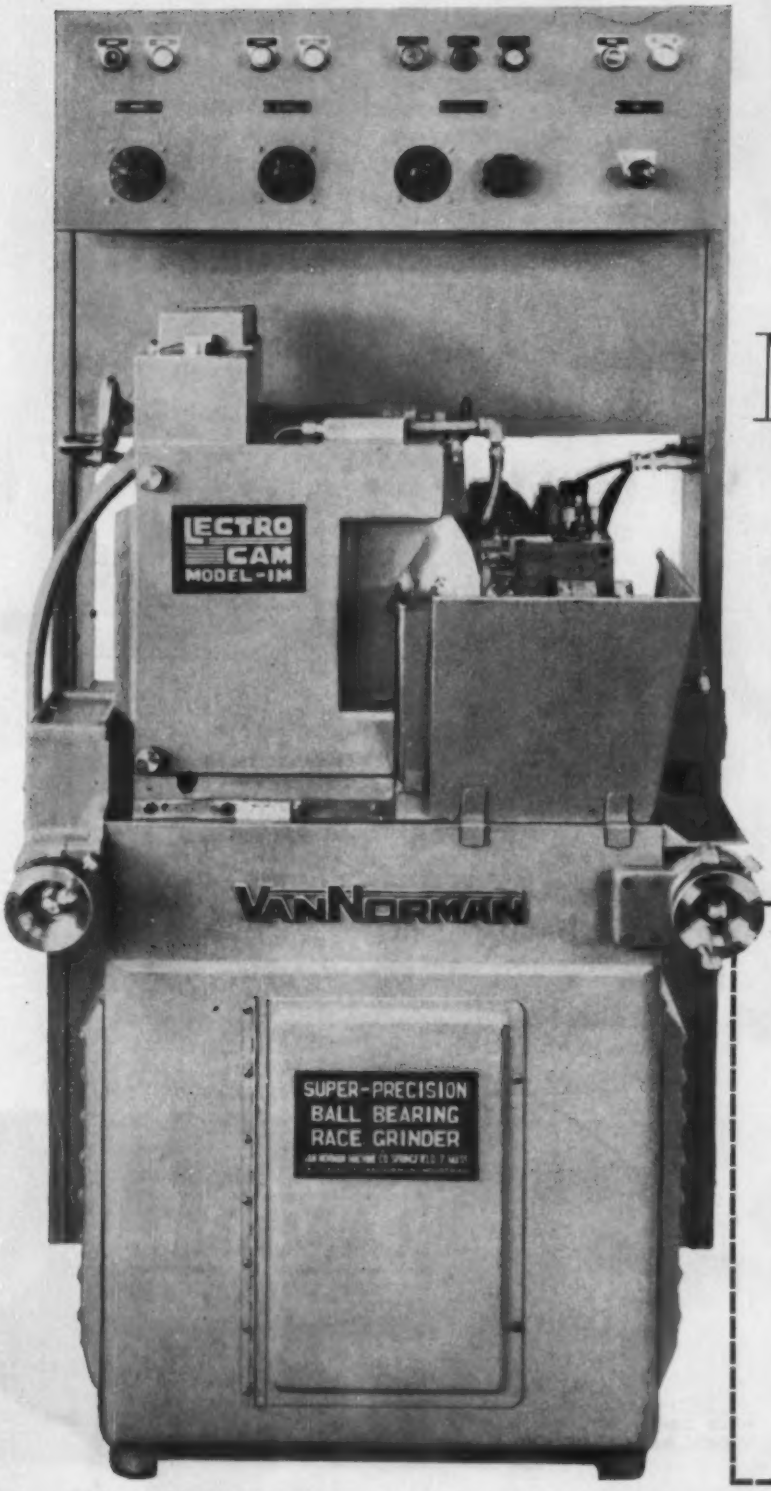
LAPOINTE

known to be the best in

BROACHING

It wowed 'em in Chicago— and it's an eye-opener for all industry!

NEW MACHINE VAN



One of the biggest draws at the MACHINE TOOL BUILDERS' EXPOSITION

All-New VAN NORMAN MINIATURE BEARING GRINDER

...plunge-cut radius grinder specifically designed to meet the requirements of the bearing industry for fast, easy, precision grinding of ball grooves on inner races of miniature bearings.

SPOTLIGHTS NORMAN POLICY OF "INDUSTRY-INTEGRATED DESIGN"

Production Benefits Most-Wanted by Each Industry Supplied by Machines Engineered to the Industry's Specific Requirements.

Van Norman "Industry-Integrated Design"— as typified by the new Model-1M Lectro-Cam Miniature Bearing Grinder—offers every industry the machines it needs for higher production, finer precision and greater savings. This broad Van Norman program is based on your own specific requirements, engineered with Van Norman know-how and skill into production tools that do the best job for *you*.

Widely versatile Van Norman engineers will work with you, and with your men at the management, engineering and production levels. You'll find that Van Norman Machine specialists speak your language. Their preferred approach to any particular machining problem is one of close cooperation with the responsible people at every stage of the design and development of a new machine tool. Your own ideas and suggestions are carefully studied, and ways are sought to incorporate them as solid benefits through sound Van Norman design principles accumulated during more than six decades.

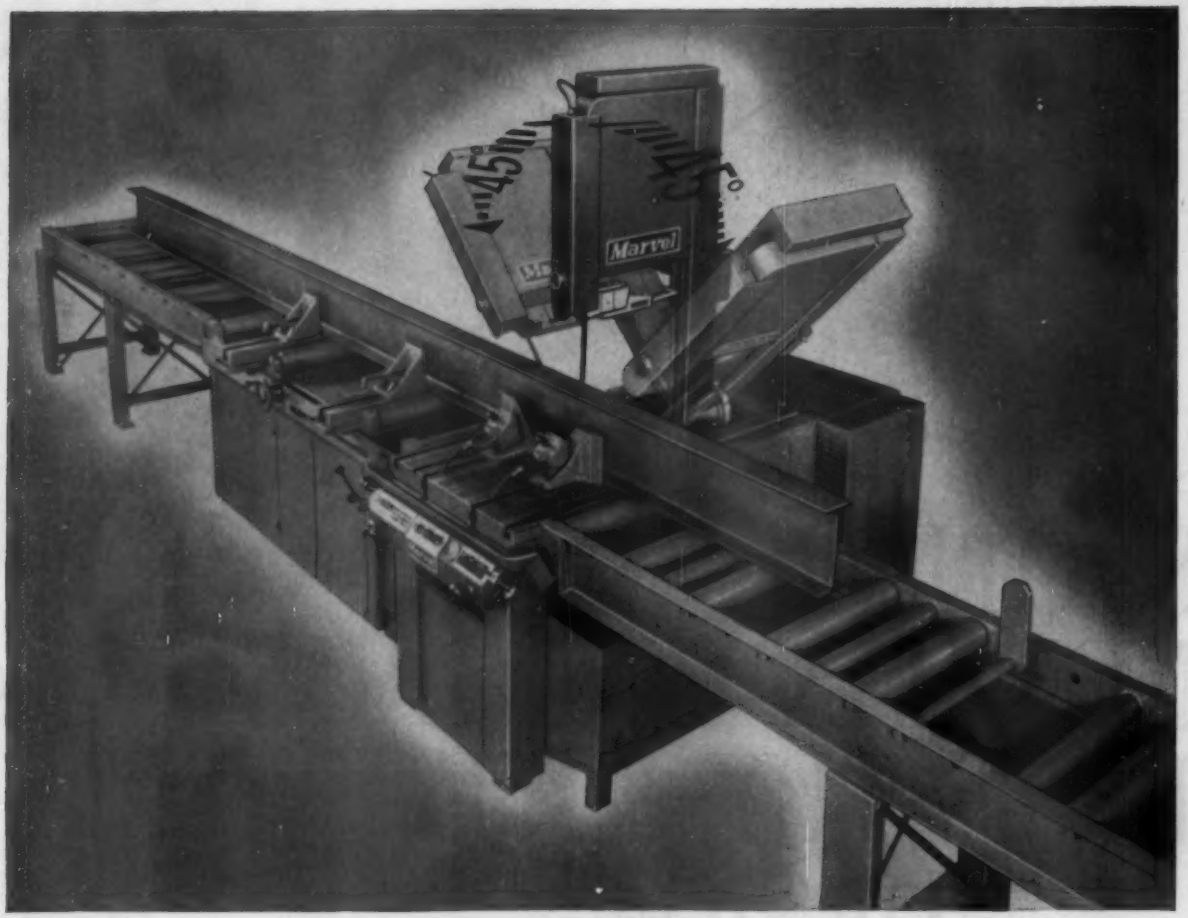
Whatever your machine requirements, you will get all-round efficiency through Van Norman "Industry-Integrated Design." Let us know your needs. Contact Van Norman Factory or Van Norman Local Machine Tool Distributor.

2608

VAN NORMAN MACHINE COMPANY

VN

SPRINGFIELD 7, MASSACHUSETTS • A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED



Tips Its Head To Cut Production Corners

Sawing 45° miters in any kind of material has always been a simple task for MARVEL Saws, but moving the work up automatically and making consecutive cuts on an angle was a problem, especially when the work was long and cumbersome.

This triple exposure photograph of a new MARVEL No. 81A All Hydraulic Heavy Duty Automatic Bar Feed Band Saw, illustrates how the upright head or column can be tipped 45° either right or left of vertical to make angle or miter cuts. The work is held stationary while the column, which carries the blade, is fed forward, meeting the work squarely to insure accurate cutting. After the cut is completed, the work is automatically moved up and measured, and another cut made.

Automatic miter cutting is just one of many exclusive universal features of these band saws. Designed to utilize every advantage of high speed steel band blades, MARVEL No. 81 Series Band Saws can handle almost any conceivable sawing job—from the smallest, most delicate work, up to 18" x 20" shapes.

Only the MARVEL No. 81 Band Saws have the "SURE-LINE" Automatic Accuracy Control (basic patent applied for) which literally steers a blade to make a straight cut. This unit extends usable blade life as much as 50%.

MARVEL No. 81 Series Band Saws are proving themselves daily, as the most versatile machine tools in production metalworking plants.

For complete details, or a demonstration of MARVEL Sawing Equipment, write: Armstrong-Blum Manufacturing Co., 5700 W. Bloomingdale Ave., Chicago 39, Ill.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ANOTHER NORTON PRODUCT

Why switch to resin-bonded belts?

You have at least two good reasons for switching to Behr-Manning resin-bonded abrasive belts:

1. They give you the benefit of cooler cutting through heat resistance in every step from roughing thru polishing, with minimum loading or shedding.

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There are two principal types of Behr-Manning resin-bonded abrasive belts:

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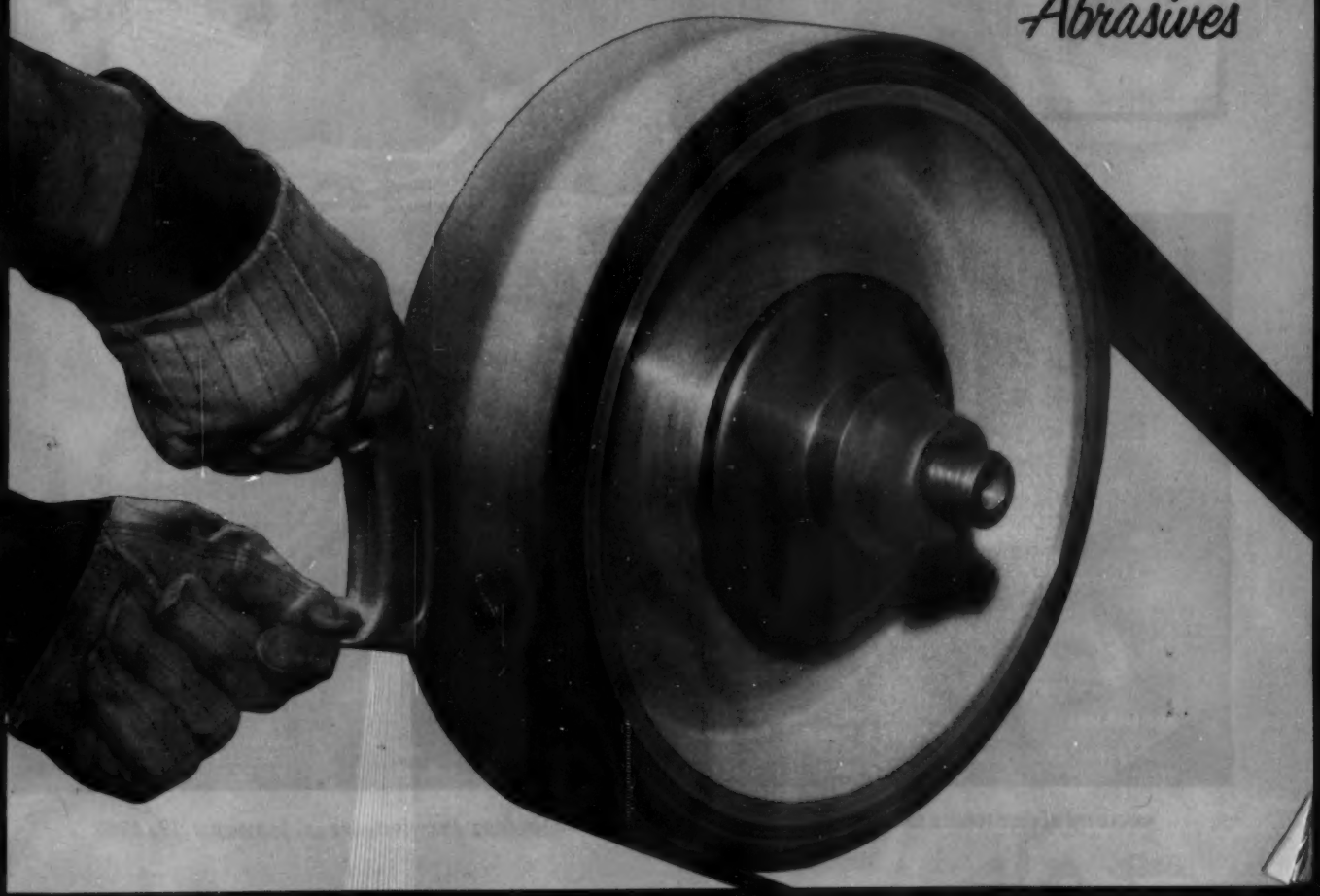

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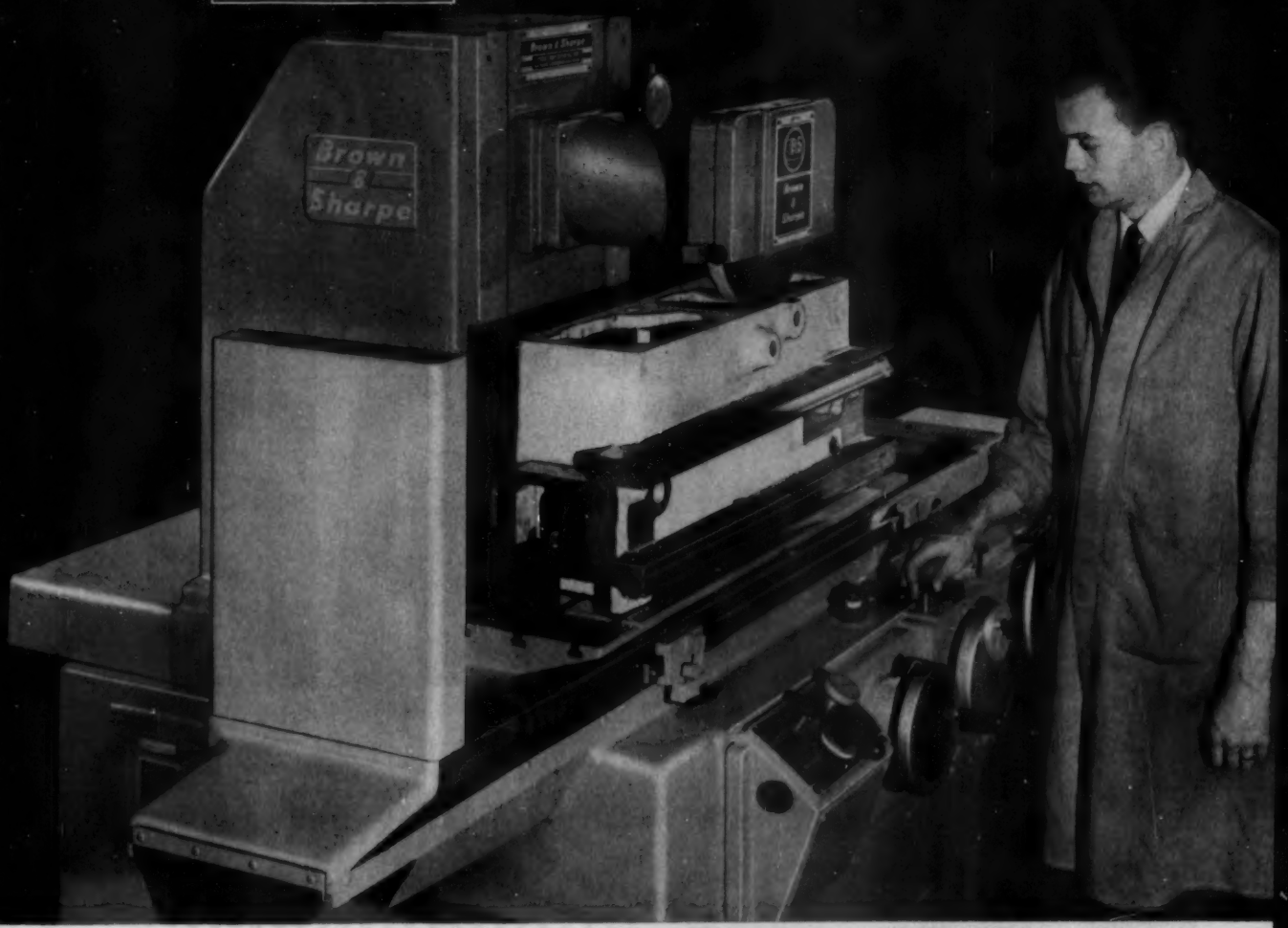

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The broad based, rugged construction assures lasting precision to ten-thousandths, and flawless microinch finishes. You can choose the 5HP direct drive, or the 3HP Orifiex drive, according to your needs. All basic controls are at the operator's fingertips.

You can order your MICROMASTER with any of a wide selection of optional equipment, or factory-modified to give you exactly the machine you need. Why settle for less — or more?

For full information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

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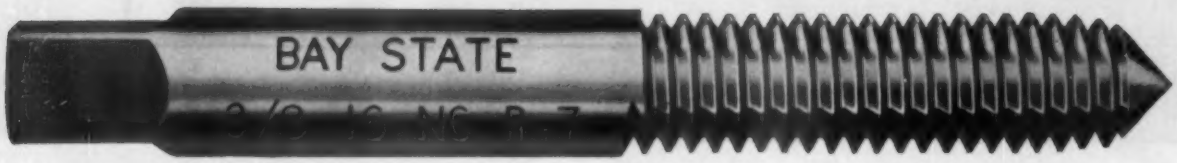

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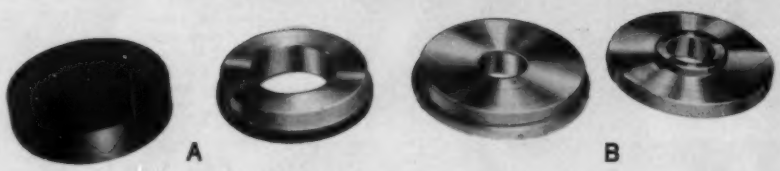
More cost-cutting IDEAS— to help you

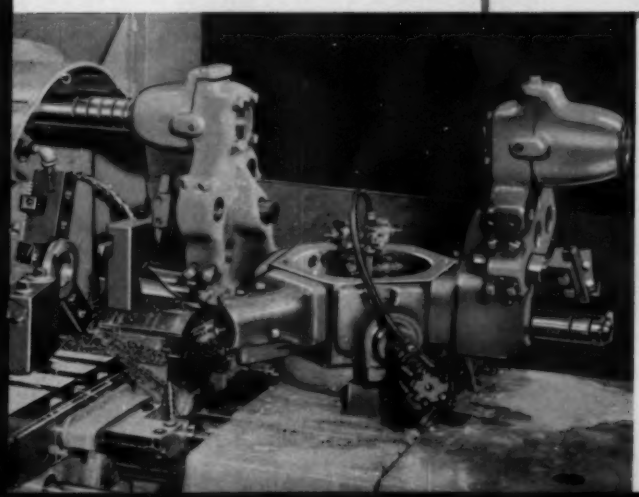
"PARTIALLY TOOLED" AUTOMATICS SHAVE 30 HOURS FROM 500-PIECE RUNS

Sheldon Machine Co. switches to Fastermatics for faster setup and automatic machining

Fastermatic® Automatic Chucking Turret Lathes can turn a neat profit even on jobs requiring only a fraction of their tooling capacity; for example, the two steel gear blank jobs shown here. Sheldon Machine Company, Inc., Chicago, builder of precision lathes, milling machines and shapers, formerly used hand-operated ram type turret lathes for this work. Now one operator using two "partially tooled" Fastermatics is saving 30 hours on one job and 32 hours on the other—every 500 pieces. In addition, the automatic cycle assures optimum tool life and repeat accuracy — .0002" to .0003" in bores.

Savings result from both faster setup and automatic cycle. One Fastermatic, a 1959 model, (shown at left), features the new Gisholt FeeDial® control. This permits the operator to preselect his feeds for any turret face in less than one minute — saving 5 minutes per station over earlier models. He can select his feeds, speeds and functions in less than 15 minutes simply by flicking switches and turning dials. Manual controls cut time normally required for preliminary tool setting, trial cuts and final adjustments.





One man operating two partially tooled Fastermatics saves a total of 62 hours on jobs A and B from time required on manually operated ram type turret lathes.

Job A: steel apron clutch gear before and after first operation. (Setup shown at left.) Thirty-two hours saved in two operations on 500-piece lots. Only three hex turret stations used to drill, turn portion of O.D., finish-bore and chamfer. Rear and front cross slides rough- and finish-face. Time, 4.8 min. f.t.f.

Job B: steel apron compensating gear before and after second operation. Thirty hours saved in two operations on 500-piece lots. Fastermatic at right above, set up to handle second operation. Only hex turret stations 1 and 4 used to finish-turn O.D., finish-bore and chamfer. Flange finish-faced from rear cross slide. Hub finish-faced and chamfered from front cross slide. Time, 2.7 min. f.t.f.

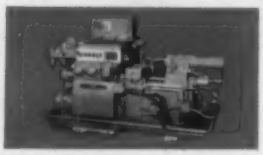
For information on the new Fastermatic with FeeDial control, circle or write in No. 729 on inquiry card.

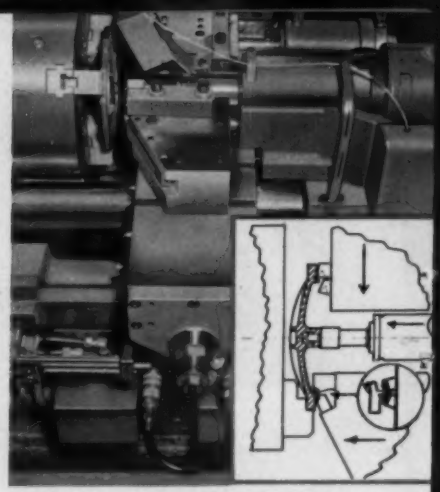
COMBINED OPERATIONS CUT TIME 30% FOR ALMCO SUPERSHEEN

Motor-driven boring unit operates with standard tooling for extra efficiency

If you're machining parts similar to the cast iron stator and rotor cover plate shown, you might profit by studying this setup. Here a Gisholt MASTERLINE® No. 12 Automatic Chucking Lathe has a separate motor-driven boring unit operating with the standard tool slides. This permits completing two operations in one chucking. In use at Almco, Queen Products Division, King-Seeley Corporation, Albert Lea, Minnesota, this arrangement has improved accuracy, eliminated one operation and attendant work-handling, and achieved a 30% reduction in overall machining time.

Four different types of stator and rotor cover plates, in a wide range of sizes, are handled by one basic setup. Lots range from 1000 to 4000 pieces. The illustration and drawing show the setup for the most complex part. The cycle is as follows: Load work and chuck on O.D. at reduced pressure to eliminate possible work distortion; machine both faces from rear independent slide; front carriage tools bore at the base of the large O.D. face, size and undercut the pilot diameter and chamfer the edges. The boring unit operates with the front carriage. Carrying a multi-diameter cutter, it drills, co-bores, spot-faces and chamfers. F.t.f. time, only 1.5 min. F.t.f. times range from 1.3 to 1.5 min. on all parts handled, 30% less than before.





Note separate motor-driven boring unit actuated by front carriage, used to drill, co-bore, spot-face and chamfer. On forward movement of multi-diameter cutter and quill, wire automatically lifts guard, which drops back after operation is completed, protecting tool during loading and unloading. Layout at right shows how tools are located and the various surfaces they machine.

Throw-away tool tips and speeder boring unit permit proper surface speeds on all cuts — increase tool life 300%. Boring unit eliminates one operation.

For information on No. 12 Automatic Chucking Lathe, write in or circle No. 730 on inquiry card.

TRACING ON TURRET LATHES SPEEDS ROCKET ENGINE PRODUCTION

Battery of Gisholt Lathes averages 75% savings on wide range of complex parts

In equipping a new plant to produce prepackaged liquid propelled Guardian I and Guardian II rocket thrust units, Thiokol Chemical Corp.'s Reaction Motors Production Plant, Bristol, Pennsylvania, was faced with a number of tough problems. Work volume was low, but highly specialized; demand for low unit cost required minimum investment in equipment; maximum machine versatility was needed for quick change-over or retooling for design changes; a wide range of work required maximum machine capacity; close contract deadlines required quick machine delivery. Twelve standard Gisholt MASTERLINE® Ram and Saddle Type Turret Lathes were selected.

For contour turning, boring or facing, the lathes were equipped with JETracers to speed machining and eliminate chance of error. Included were JETracer® units for use on bridge-type cross slides, units to control a cross-feeding hex turret, turret-mounted slide tools and, in some cases, two different units on one machine. Because the work included such a wide variety of parts in an almost unlimited range of sizes, the Gisholt JETracers offered another important advantage: flat templates. These are quickly made, easily modified, and easily filed in minimum space for quick selection.

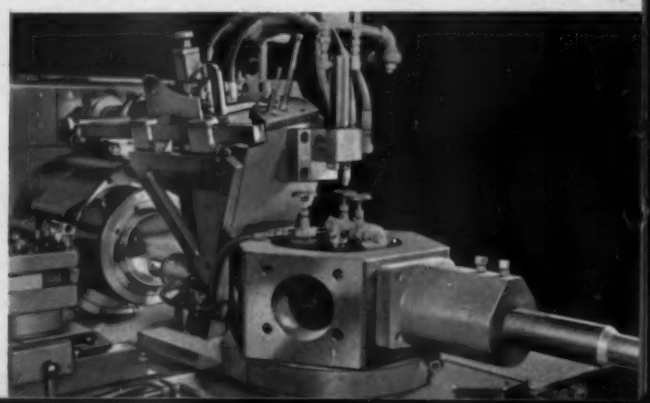
Here's maximum efficiency on short runs without high cost of special machines. JETracers and 12 Gisholt Turret Lathes average 75% savings.

Gisholt MASTERLINE 3L with two JETracers for first operation on forged copper-alloy chamber nozzles. The end is faced from the front cross slide, then straight-bored from the turret. A turret mandrel supports the end during contour-turning by JETracer on rear of bridge-type cross slide, and grooving from front cross slide. Nozzle end is contour-bored by turret-mounted JETracer slide tool. F.t.f. time, 26.2 min.

For the complete story on this multiple-machine installation, write us for the magazine reprint "Turret Lathe Contouring of Rocket Engine Components."

Or write in or circle No. 731 on inquiry card.

Gisholt MASTERLINE 3L with turret-mounted JETracer slide tool, for second operation on chamber nozzles. Turret-mounted loader presses work into centralizing ring and holding fixture. Part is faced from front cross slide and the large I.D. is contour-bored with the JETracer. A 125 micro-inch R.M.S. finish is obtained, and tolerances of .002" are consistently held. F.t.f. time, 20.3 min.



5 AR® SAVES 8 MINUTES PER PIECE FOR MURDOCK

JETracer on hex turret operates as part of automatic cycle

Doing small-run bar and chucking work on hand-operated machines or expensive single-purpose automatics? You'll be interested in the setup being used by Murdock Machine & Engineering Co., Inc., Wichita, Kansas.

Doing contract manufacturing, this firm specializes in milling and turning. In their own reasoning, a Gisholt AR (Automatic Ram Turret Lathe) was selected for its versatility in job shop operations requiring fast setup and standard tools . . . for its capacity to handle a wide range of both bar and chucking work . . . and for the economies offered by the automatic cycle. For an example of how the AR provides cost-cutting performance, read the caption at right.

AR Turret Lathe with JETracer saves 8 min. per piece. Savings average 50% on all jobs. Machine sets up as fast as a hand-operated turret lathe, changes from bar to chucking work in 30-40 min.

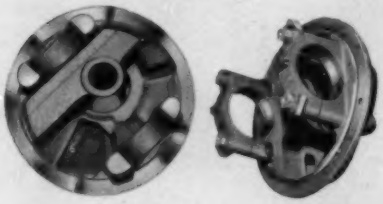
Murdock's No. 5 AR has an Air-draulic bar feed and a turret-mounted JETracer slide tool for contouring. Here's the cycle for a coupling shaft, shown, machined from 2"-diameter, hot rolled 4140 steel bar stock: stock feeds to length against turret stop; collet closes; hex turret box-turns two diameters; front cross slide rough forms two diameters and associated radii; turret-mounted JETracer automatically finish-traces from end face to O.D. of large flange end; hex turret drills, and rear cross slide cuts off. Then, cycle repeats. Time: 3 min., 15 sec. Previous methods, 12 min.

For information on No. 5 AR, circle or write in No. 732 on inquiry card.

SIMPLIMATIC® OFFERS "BUILDING-BLOCK" BENEFITS ON DIFFICULT PARTS

Independent slides positioned to suit the work for maximum efficiency

How would you machine the large O.D. face and the interrupted surfaces on these high-production parts? You could use a



specially designed machine — or a standard lathe requiring a sequence of cuts. Or you could use the Gisholt MASTERLINE Simplimatic Automatic Chucking Lathe which offers the best of both machines—at *standard* machine prices.

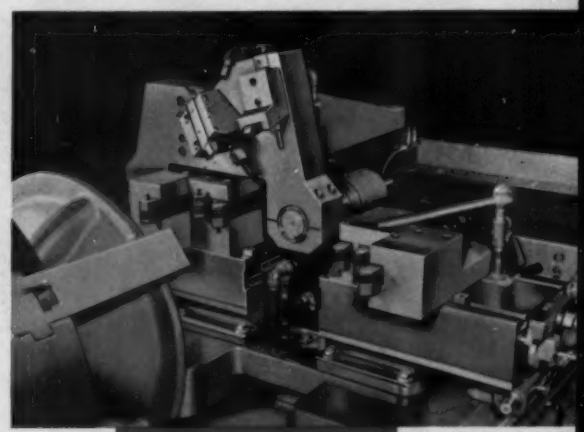
This versatile machine is the essence of the building-block principle: a standard headstock and bed casting; and a wide, flat platen table that permits the use of standard front, center, rear or auxiliary slides with tool blocks where they are *needed* for each job. Slides may feed at different rates, permitting an unlimited variety of cuts and tool approaches. The screw-fed table can advance rapidly to position the tools or can feed to plunge tools to depth, turn an O.D. or bore, before slide movements begin.

The captions tell how the two Simplimatic setups shown here are used by International Harvester Co., Inc.'s, Fort Wayne, Indiana, Motor Truck Plant, to handle the parts shown, above left.

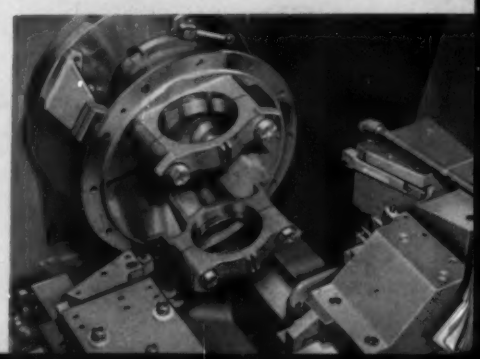
Over five sizes are handled with no additional tooling. Simplimatic offers maximum flexibility plus capacity . . . does the work of special machines at standard machine cost.

For information on Simplimatic Lathe, circle or write in No. 733 on inquiry card.

Setup for a cast iron, 20" O.D. differential carrier. The tools on front, rear, and pedestal-mounted center slides operate simultaneously. Flange is rough- and finish-faced; register diameter is turned and chamfered, and four half-bearing faces are machined. Time: 5 min. f.t.f. — compared to 9.68 min. by previous methods.



After a cap assembly is added, the work goes to a second Simplimatic. A spindle positioner speeds loading. Again, three standard slides are used — each positioned to suit the work. Register diameter is finished, and the four interrupted radii on the bearing cap ears are rough- and finish-turned and chamfered. Time: only 4.4 min. f.t.f. — compared to 7.59 by previous methods.



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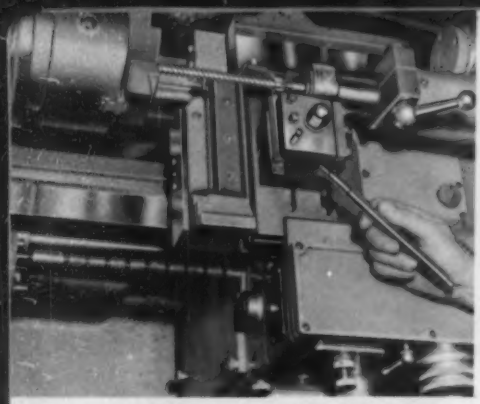
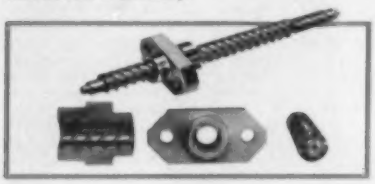
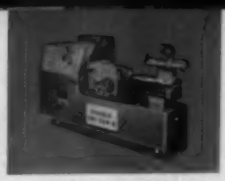


CRI-DAN "B" setup for 4-start adjusting screw, shown below. Note the stop roll at left of saddle. This permits cutting extra-length threads with no loss in accuracy.



Aircraft rudder pedal adjusting screw and nut assembly (for Lockheed Model C-130 airplane) shown at top. Bottom (left to right): adjusting nut, sectioned and end view to show internal 4-start thread; adjusting-screw end view to show 4-start thread.



CRI-DAN SAVES 65 MINUTES ON 4-START THREADING JOB

Single-point threading tools eliminate thread milling and expensive taps

Interested in cutting threading costs? Then you'll want to study this Gisholt CRI-DAN "B" Threading Lathe setup used by Orlando Machine Tool Co., New Smyrna Beach, Florida.

Two parts are involved: a long aircraft rudder pedal adjuster screw made of SAE 4130, heat-treated to 25-30 Rc, and a mating nut, made of aluminum bronze. Parts are used on the Lockheed Model C-130 airplane.

The screw requires a ½"-10 4-start Acme thread, with 1" lead, 5¾" long, .060" deep. Previously, this thread was milled in 1½ hours. Now a CRI-DAN "B" completes the part in only 25 min. f.t.f. The CRI-DAN is equipped with a 64-pass mechanism and a special stop roll that permits completing the 5¾"-long thread even though standard machine capacity is 3¼". After cutting part of the thread the saddle is re-located, using the stop roll. Accurate lead pickup is assured with no loss in accuracy, even on this tough, 4-start threading job. The single-point tool makes 60 automatic passes with .001" tool in-feed per pass, producing a 65 micro-inch R.M.S. finish.

The nut requires 32 passes, with .002" in-feed per pass. F.t.f. time, 15 min. Tap costs alone would have been $490. Compare this to the cost of single-point tools used by the CRI-DAN.

CRI-DAN "B" saves 65 min. per adjusting screw . . . uses cost-cutting, single-point tools in place of milling cutters or taps. Stop-roll feature stretches threading capacity with no loss in accuracy.

For complete information on CRI-DAN Threading Lathe, write in or circle No. 734 on inquiry card.

MISSILE GYROS BALANCED FASTER, MORE ACCURATELY ON GISHOLT HS

Air drive and special fixture simplify balancing of unusual part

If your work includes miniature high-speed parts or assemblies, you'll find Gisholt HS Balancers of interest. These machines handle armatures, aircraft and missile gyros, small spindles, turbines, etc. They accurately measure and locate unbalance causing movements as small as .000002".

An example is the piece shown here — a Rolleron Gyro manufactured by R. C. Allen Business Machines, Inc., Grand Rapids, Michigan. This unit is used to stabilize the Sidewinder aircraft-fired missile. Powered by air streaming past the stabilizing fins on the missile, the toothed wheel attains very high rotational speeds. Extremely close tolerances must be held to assure proper functioning.

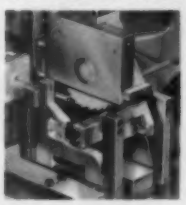
Shown on a Gisholt HS-2 Balancer, air drive accelerates the assembly to 8000 r.p.m. in just 5-8 seconds. Readings are taken in two correction planes. A light-dark finish variation on the toothed wheel triggers a photo tube pickup. This provides angle reference and indicates speed through a tachometer. Amount, in terms of drill depth and angle of unbalance is shown on separate direct-reading meters.

To maintain tolerances of less than 100 micro-ounce inches in each plane, the assembly passes through the balancer three times for a rough correction, final tolerance correction and inspection. Production —40 to 50 assemblies per 8-hour shift.

Gisholt HS-2 Balancer provides more accurate plane separation, angle indications and amount measurements, eliminating excessive correction cycles. Balancer is easily changed over to belt drive for other gyro parts.

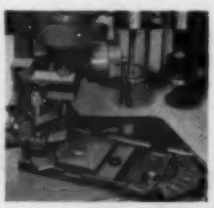
For complete information on HS Balancers, write in or circle No. 735 on inquiry card.

Gisholt HS-2 Balancer with fixture supporting Rolleron Gyro assembly. Note direct-reading amount and angle-of-unbalance meters at top right, and expanded scale tachometer below. Inset: Rolleron Gyro, with paper clip for size comparison.



Close-up of part in fixture. Note air-drive orifice at base of toothed wheel that accelerates the wheel to 8000 r.p.m. in 5-8 seconds, and maintains speed during location and measurement of unbalance.

Correction drill press has micrometer depth adjustment. Placed in a fixture, work is corrected in one plane, then turned and located at other end of fixture and swung under drill for second plane correction.



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MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Table in shaving position

Significant design innovations in the New Model GCX enable you to shave the larger, heavier gears (up to 24" Pitch dia.) with the same facility and precision as smaller gears are shaved.

Methods of loading and unloading are unrestricted. The work is loaded with the table at the extreme limit of its travel—clear of any overhead interference.

At the end of the shaving cycle, the cutter head rises in rapid traverse to clear the work and the table returns to its loading station for quick unloading.

If you manufacture such gears as are used in trucks, agricultural or ordnance equipment, ask for Bulletin S60-8 and get the full details of this new, economical method of gear shaving.

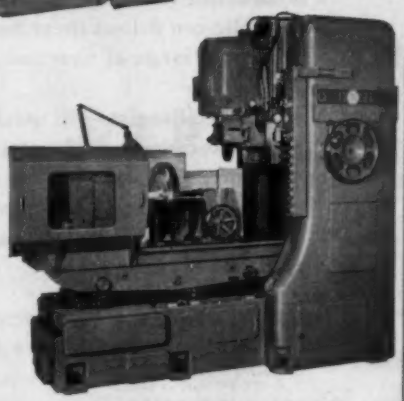

Table in loading position

EXCLUSIVE RED RING ADVANTAGES

- Cutter above the work permits chips to fall away from and not into the cutter teeth.
- Thus positioned, the cutter is not vulnerable when the work is accidentally dropped while being loaded.
- Cutting pressure is applied downward, taking full advantage of gravity for rigid stability.
- Floor space, less — Rigidity, greater

SPUR AND HELICAL GEAR SPECIALISTS ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

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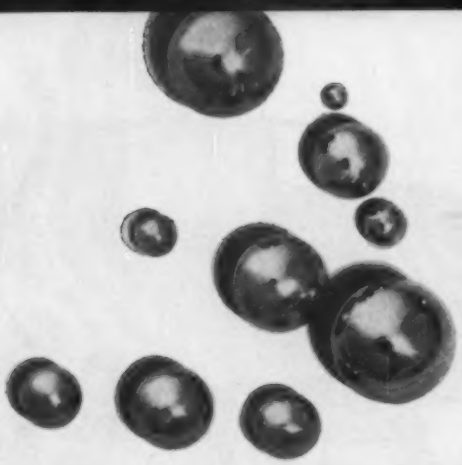
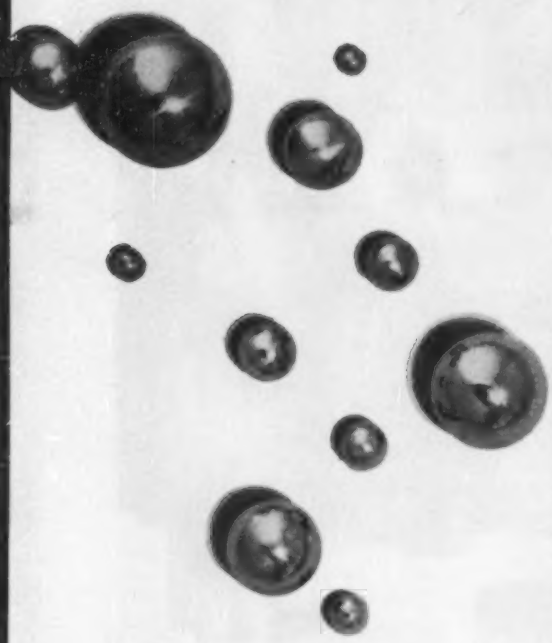


DURABLE IN THE EXTREME



...parts produced from Republic VACUUM-MELTED Metals

A leading manufacturer of ball bearings uses Republic Type 52100 Vacuum-Melted Alloy Steel in bearings produced for aircraft and missile applications. This steel provides excellent resistance to erosion, corrosion, abrasion, and impact. The alloy is supplied to the manufacturer in bars. It is then drawn into wire rods, annealed, drawn to size, sheared into slugs, forged, heat treated, rough ground, tempered, finish ground, and polished.

Produced by the consumable electrode process, Republic Vacuum-Melted Metals offer higher mechanical properties—ductility, tensile strength, and longer fatigue life—with nonmetallic inclusions reduced in number and size. Republic can deliver these metals in quantity on time, and in a wider range of sizes and conditions than ever before possible.

Our metallurgists will quickly help you select, apply, and process vacuum-melted metals: *super alloy steels, constructional alloy steels, high strength alloy steels, bearing steels, stainless steels, titanium,* and *special carbon steels.* For complete information, contact your nearest Republic sales office or return the coupon.

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REPUBLIC VACUUM-MELTED METALS are produced in 18- to 32-inch diameter ingots weighing from 4,000 to 20,000 pounds. These can be processed into billets, sheets, bars, strip, and wire to meet your precise requirements.

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REPLACE COSTLY ASSEMBLIES: Republic Cold Drawn Special Section Bars are formed to the predominating cross section of your part. By eliminating or greatly reducing machining, special sections permit faster production at lower unit cost. Completed parts—*one-piece parts*—are longer wearing because cold drawing improves mechanical properties. Republic Special Section Bars are available in carbon, alloy, and stainless steel. Send for information.

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- ☐ CENTURY SERIES Booklet
- ☐ Cold Drawn Special Section Bars

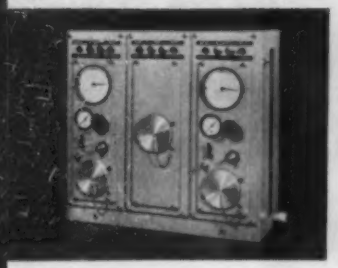
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

How many of these products



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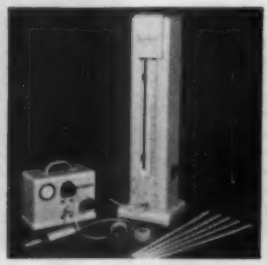

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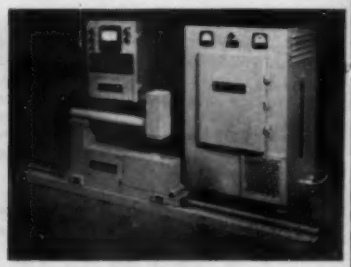

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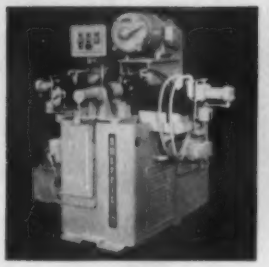

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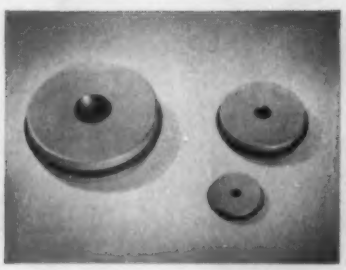

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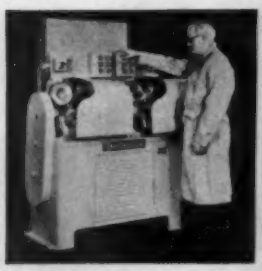
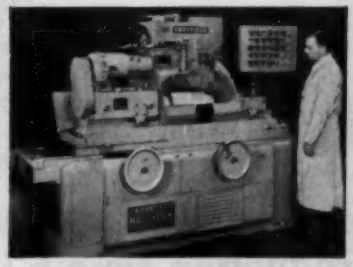


18

1. Pneumatic gage control unit
2. Pneumatic Recorder
3. Precisionaire® gages
4. Measuray® thickness gage
5. Crankshaft gage
6. Multiform grinder
7. Machine control unit
8. Thread rolling machine
9. Double end precision threading machine
10. Automatic piston pin gage
11. Plunjet airsnap
12. Thread and form grinder
13. Automatic bearing assembly machine
14. Airetest® indicator
15. Press-Pacer® transfer machine
16. Monitorecord® machine operations analyzer
17. Master setting rings, xxx and xxxx
18. Gear chamfering machine
19. Micro-Form grinder
20. Plunjet® gaging cartridges
21. Cavitron® ultrasonic metal working machine

can you identify?

5



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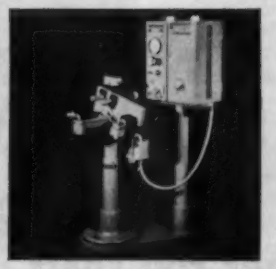

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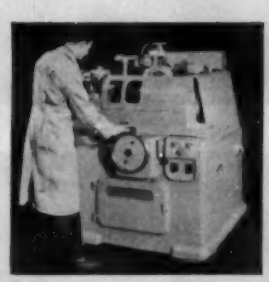

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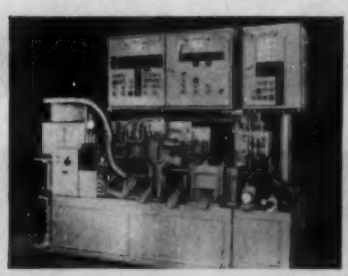

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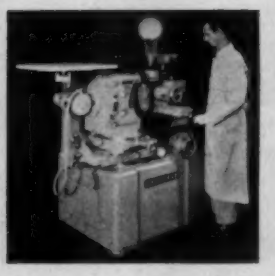

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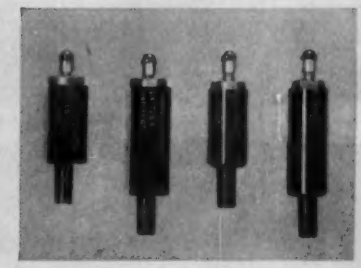

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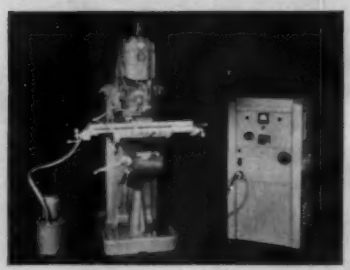

21

Here are just a few of the many precision products Sheffield makes. You'll do well to identify as many as six of those shown. May we send you a copy of Catalog No. GC957 showing more of Sheffield's complete product line?

Or for specific information, just circle the number, clip the ad and mail. We'll send the appropriate catalogs.

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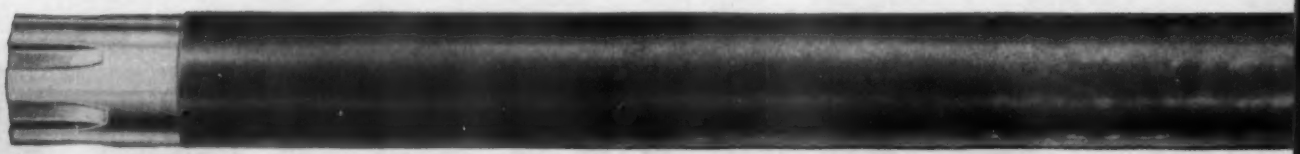
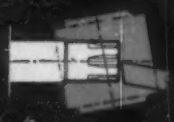
CIRCLE 192 READER SERVICE CARD

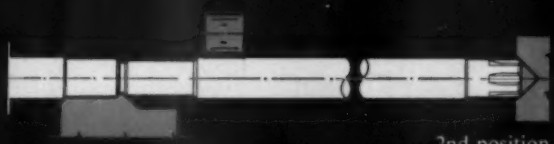
Acme-Gridley performs spline hobbing in a single set-up . . .

slashes wringer roll shaft production time 63%!

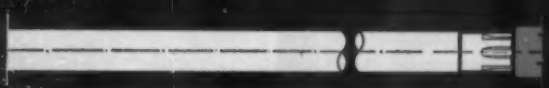




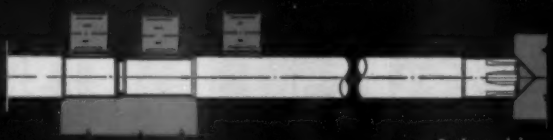
5th position
Hob Spline—Face Front (spindle clutch disengaged, spindle driven from hobbing attachment)



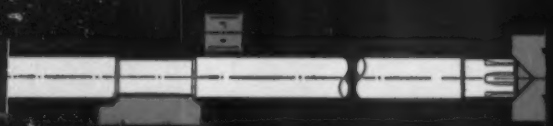
2nd position
Form Spline Dia. of Next Piece and Breakdown for Cut-off—Support



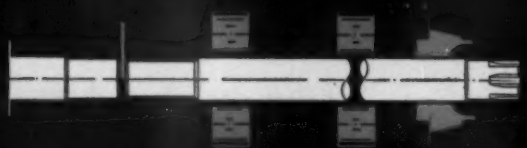
6th position
Feed Stock



3rd position
Shave Rear Dia. and Spline Dia.—Support



1st position
Form Rear Dia. Past Cut-off—Support



4th position
Support—Pick-up—Cut-off

6 Operations in 27.9 Seconds

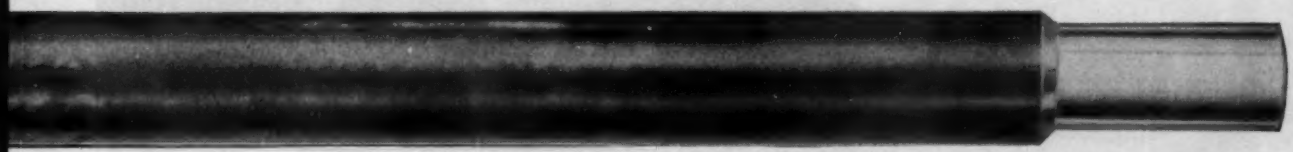
Here's how imaginative National Acme solutions to tough machining problems extend total machine capability and pay off in *tangible* production savings.

Spline hobbing is generally considered beyond automatic bar machine capability. Yet, an ingenious National Acme hobbing attachment . . . installed on an Acme-Gridley 1¼″ RA-6 with modifications . . . lets a well-known manufacturer of wringer roll shafts do spline hobbing in the primary set-up; has cut per-piece production time 63%. In addition, a unique automatic feeding arrangement has drastically reduced stock-loading downtime.

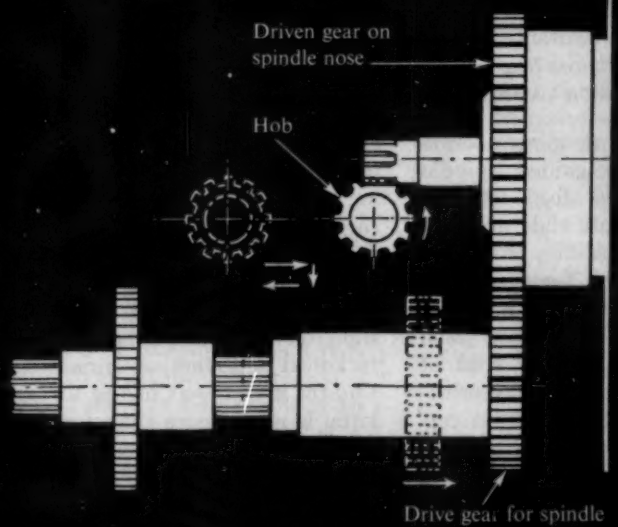
Special attachments like the spline hobber, plus such standard features as direct camming, independently operated toolslides, and a wide open tooling zone are the reason Acme-Gridley capability is limited by imagination only. No wonder cost-conscious manufacturers everywhere depend on Acme-Gridleys for higher mass production efficiency at lower cost. Detailed information on the world's most complete line of multiple and single-spindle automatic bar and chucking machines is yours for the asking. Call, write or wire.

National Acme's "Zone of Responsibility" includes all phases of cost reduction. Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by thousands of manufacturers . . . an "everyday" job for Acme-Gridleys. **Indirect Costs:** effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc. **Product Redesign:** teaming with your design group to take full advantage of Acme-Gridley's cost reducing capabilities. **Direct Material Costs:** our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems. **Make-or-Buy Reviews:** in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment. **Spot Modernization:** pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.



Spline hobbing in the fifth position . . . a closer look



When the hobbing attachment advances, a gear on the attachment engages a gear on the spindle nose and drives the spindle at the required speed for hobbing.

MMT-PE

National Acme

THE NATIONAL ACME COMPANY
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CLEVELAND 8, OHIO

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

New Economics of

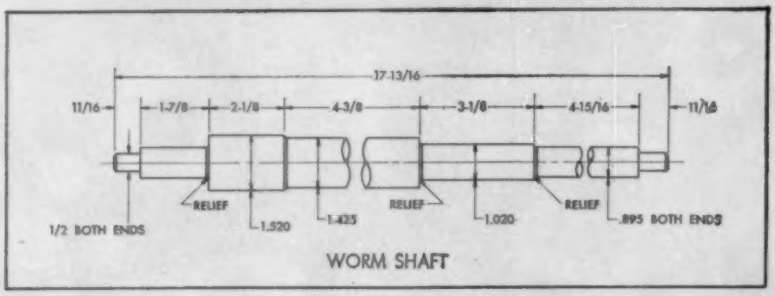
Big money being wasted because of traditional concepts in lathe utilization can now be saved.

The two jobs illustrated, taken from the same lathe department, prove that Barber-Colman's new 1610 "specialist" lathe—for turning, facing, and boring—is an economically sound machine concept for almost any shop.

Elimination of threading equipment—features which are not fully utilized on many lathes—produces an initial cost saving that can pay for a hydraulic tracer. The manufacturer of these parts (below) had plenty of threading capacity on older machines, so he elected to take a valuable hydraulic tracer for the cost of threading equipment he really didn't need.

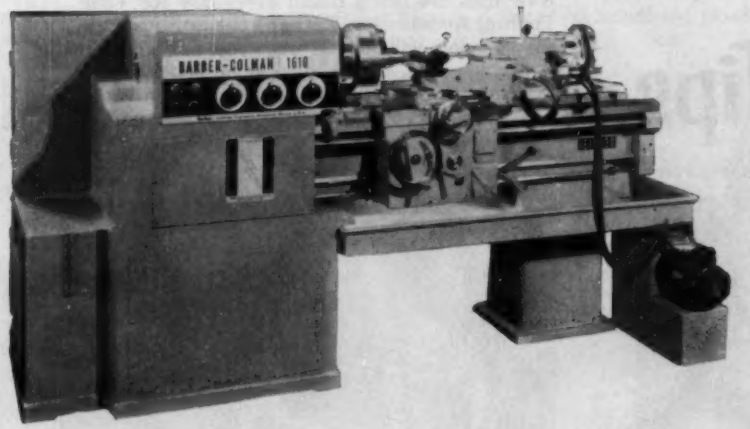
Of course, there are many operating benefits to be gained. Spindle speed and power feed to both carriage and cross slide are infinitely variable. Ability to change both speeds and feeds without stopping the machine increases production on a great many jobs. Over-all result: A new kind of lathe specialization that minimizes capital investment for certain classes of work and opens a valuable opportunity to improve *total* machine utilization. Here are some of the specific results this manufacturer achieved.

The worm shaft was shifted from a turret lathe to the tracer-equipped Barber-Colman 1610 for facing, center drilling, and turning. Threads are now cut on a threading machine. This shift reduced total cutting time 32% and setup time 12% (including time on a threading machine). But time on a machine has to be reckoned in dollars, not minutes. Capital investment in the turret lathe is much more than for the 1610 lathe. What's more, the operator of the turret lathe is a Class



WORM SHAFT

Report shows how one Barber-Colman turning lathe initiated important methods improvements throughout a department.



"Specialist" Lathes

A, while the operator of the 1610 is Class B. And to further prove how ultimately practical this new lathe is, the Class B operator not only turns out more work, he also scraps fewer parts.

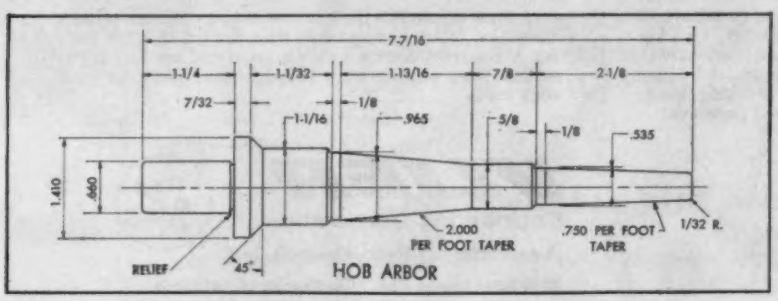
Utilization: tracer vs threading

Perhaps you are in the same position as this manufacturer: You have enough lathes to handle your threading requirements, but not sufficient tracing capacity. If so, a 1610 with tracer will be a particularly profitable investment for you. Take this hob arbor as an example.

By shifting the job from a conventional lathe without tracer to a tracer-equipped 1610, production was increased over 100%—from 1.5 to 3.3 pieces per hour. Setup time was reduced 40%. The important point is, this manufacturer is now using both his old lathes and his new machine more profitably. Here's why.

Maximum cutting speed on the old lathe was 632 rpm and feed was .0092" per revolution. On the 1610 FT, speed *ranges* from 900 to 1500 rpm and feed is .015" per revolution. A load meter allows the operator to obtain maximum production. In other words, there's quite a difference in capacity between an old lathe and a modern lathe. And since threading normally requires *slow speeds*, doesn't it make sense to thread on your older machines—and do turning, facing, and boring operations on this high-speed "specialist"? Why put low-speed work on a high-speed lathe?

The 1610, with 16" or 20" swing and 6½ hp motor, is a precision lathe capable of turning out toolroom quality work. If you are in the market for a new lathe, phone your Barber-Colman representative or write us for descriptive literature and complete specifications. Ask for Bulletin No. 9061-1.



Barber-Colman Company

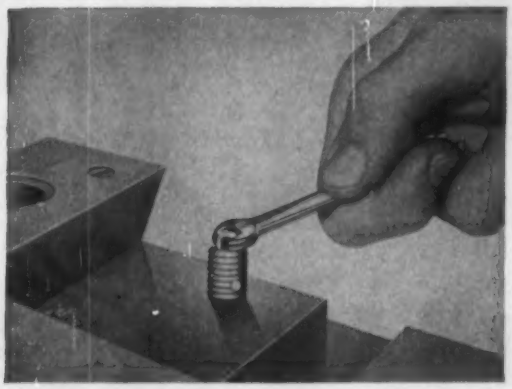
BARBER COLMAN

91 Loomis Street, Rockford, Illinois

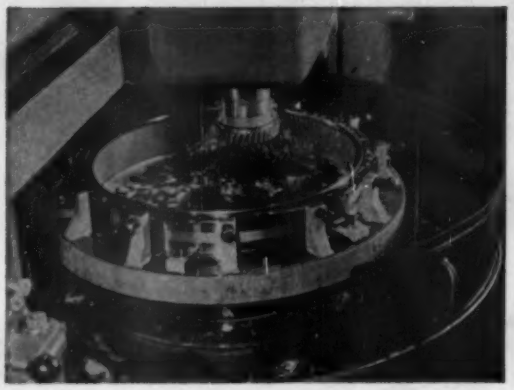
Practical Tooling Tips

No. 4 of a series

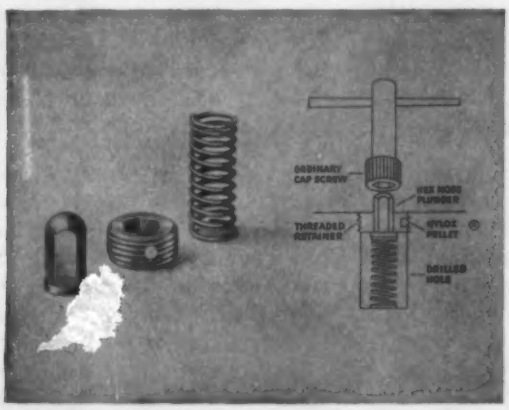
New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.



NEW PLUNGER ASSEMBLY PREVENTS DAMAGE TO DIE STOPS—Plunger actuates automatic stop perfectly. Quickly installed, never needs adjustment. Hex nose mates with standard hex head bolts for easy insertion. Nylok® nylon pellet prevents threaded retainer from working loose. 8 sizes from ¼" to 1" diameter. Various end pressures.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

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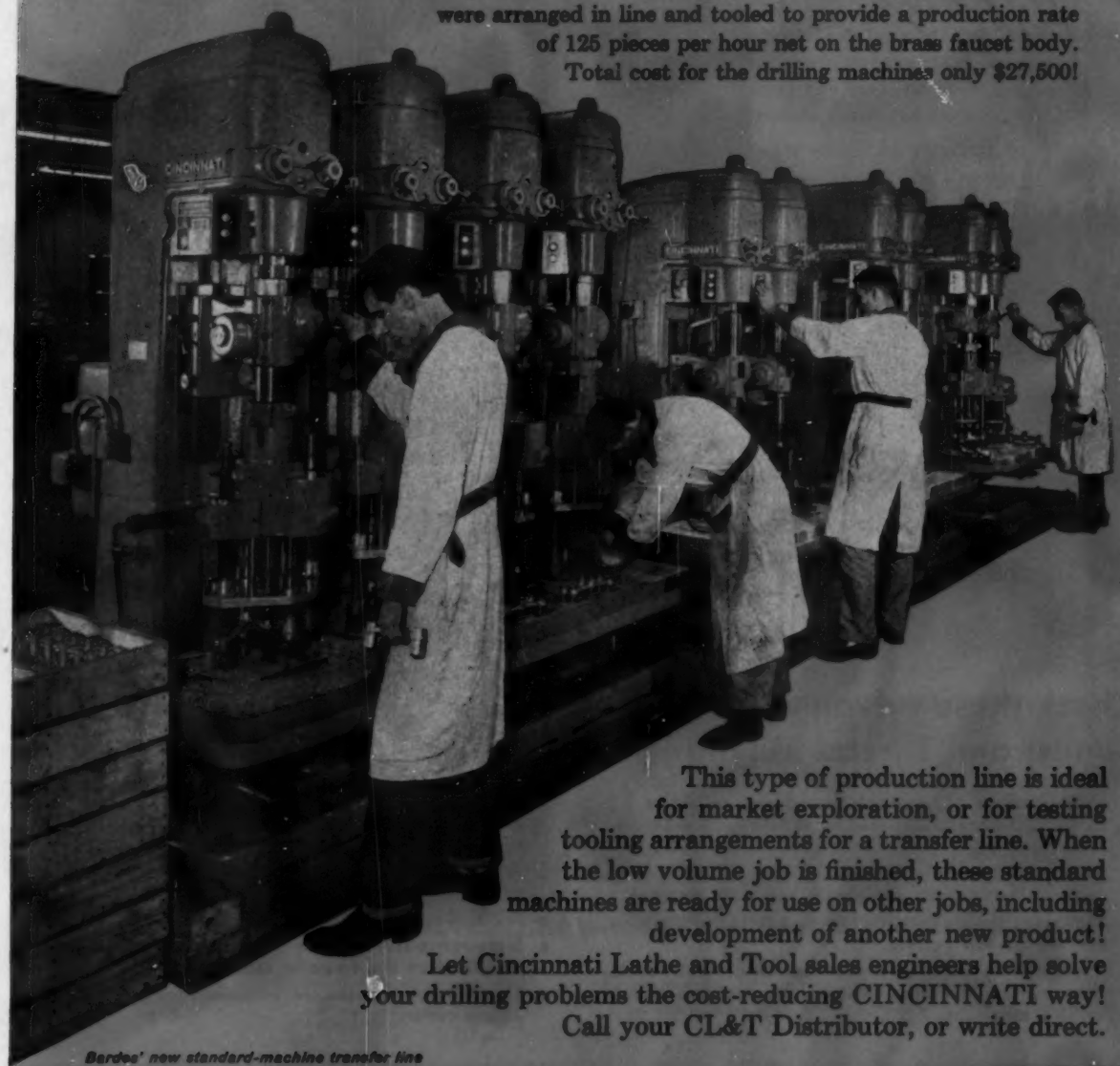
WANTED! *Production line economies for market exploration...*

At Bardes Corporation in Cincinnati, Milt Garvin, Vice President, talked over this problem with his Cincinnati Lathe and Tool distributor. "We continually develop new plumbing products—like this faucet body which has 30 operations including drilling, hollow milling, boring, tapping and threading. We'll use a transfer machine when we hit high volume. Right now we need a machining line for low-cost, diversified small-lot production."

DELIVERED! *A low-cost machining line from standard machine tools...*

Four CINCINNATI 21" Sliding Head Drills—one 4-spindle and three 2-spindle models—were arranged in line and tooled to provide a production rate of 125 pieces per hour net on the brass faucet body. Total cost for the drilling machines only $27,500!

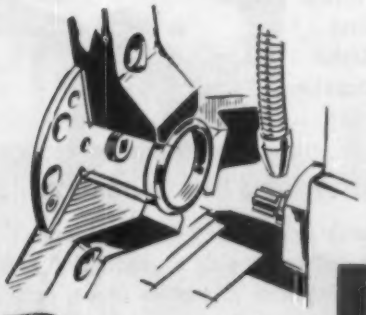


This type of production line is ideal for market exploration, or for testing tooling arrangements for a transfer line. When the low volume job is finished, these standard machines are ready for use on other jobs, including development of another new product! Let Cincinnati Lathe and Tool sales engineers help solve your drilling problems the cost-reducing CINCINNATI way! Call your CL&T Distributor, or write direct.

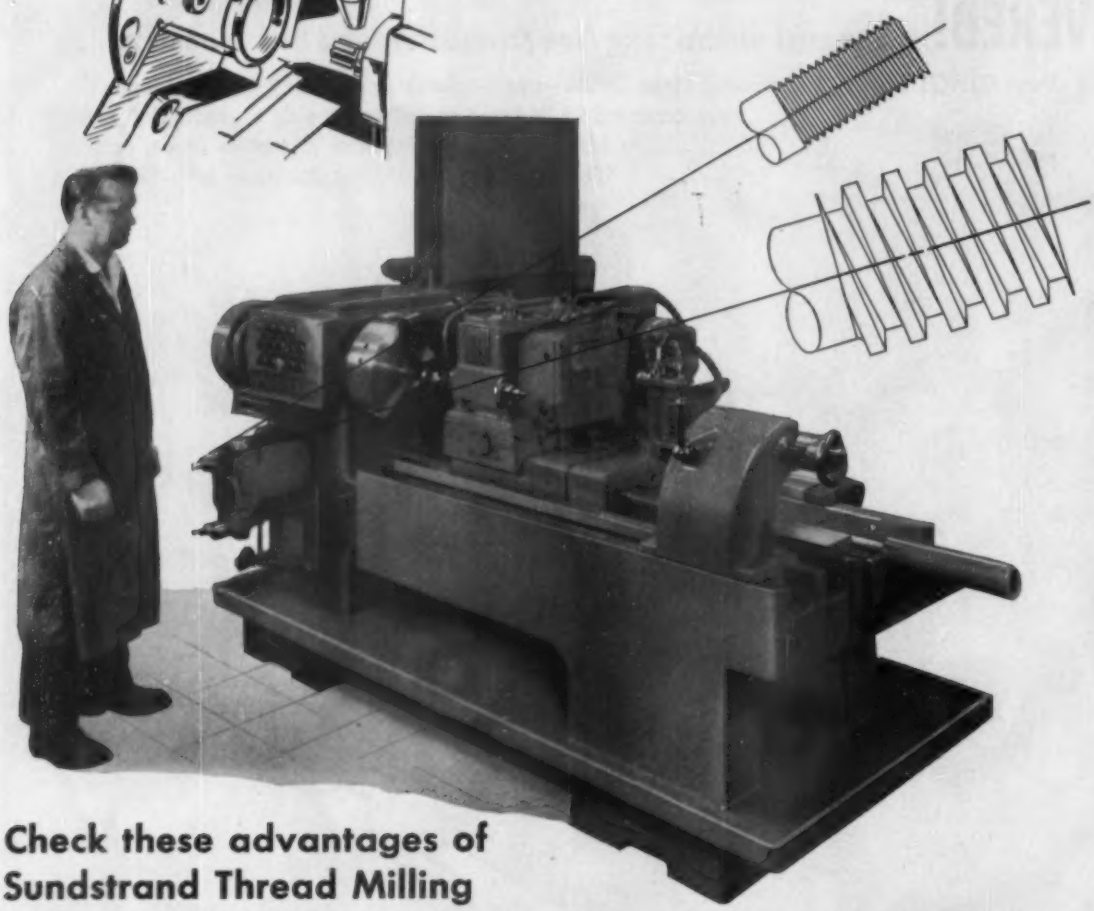
Bardes' new standard-machine transfer line for low-volume plumbing equipment.

CINCINNATI LATHE AND TOOL CO.
Cincinnati 9, Ohio
HYDRASHIFT Lathes • CINCINNATI Drilling Machines • SPIROPOINT Drill Sharpeners

New Sundstrand Machine

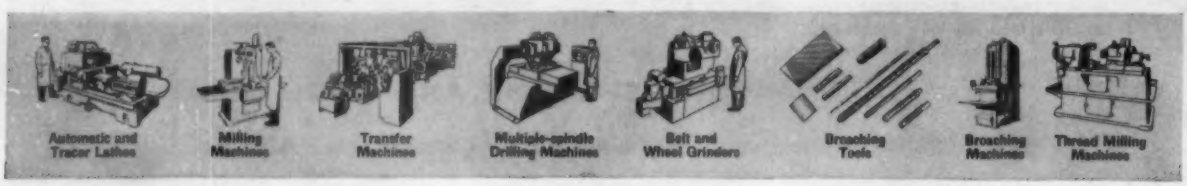


The cutter rotates as it feeds full thread depth into the rotating workpiece. While the workpiece makes one revolution, the cutter is moved lengthwise the exact amount of lead required.



Check these advantages of Sundstrand Thread Milling

- Mills internal or external threads . . . right or left hand . . . straight, tapered or special . . . with any lead up to ½".
- Produces internal or external threads on interrupted work surfaces, such as splines, key slots and flutes.
- Machines thread pitches too coarse to be practical for die or tap cutting.
- Produces faster at lower cost than single-point tools, disc cutters, grinding wheels, or previous thread milling machines.
- Makes external threads one pitch away from a shoulder, internal threads one pitch from the bottom of a blind hole.
- Accurately relates pitch diameters to other elements of the workpiece.
- Mills threaded and plain diameters simultaneously.
- Simultaneously mills two threads of the same pitch and lead on the same or different diameters.
- Threads workpieces of various diameters with a single cutter.



Simplifies Thread Milling

features sine bar adjustment for threads up to ½" lead, fully automatic cycling, and five minute change-over.

The new Sundstrand Universal Automatic Thread Milling Machine speeds production, insures accuracy, and minimizes scrap loss on a wide range of threading operations, including those difficult, costly, or impractical by any other method.

The machine employs multiple thread cutters having no lead but with the desired pitch and thread form. The new and exclusive sine bar mechanism is dial-adjustable to provide an infinite range of thread leads of 0 to ½".

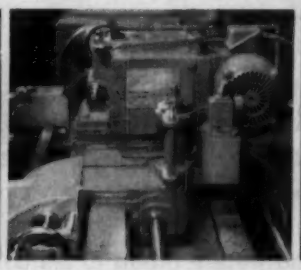
Because there are no gears or cams to change for different thread leads, change-over to a new part is fast and easy. Setup can be completed in about five minutes after the cutter and part are placed in position, making the machine ideal for short or long runs on a wide variety of parts.

No special operator skills are required to consistently mill high-quality uniform threads — the machine easily produces to the exacting requirements of military and aircraft specifications.

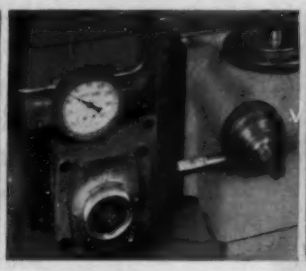
Four models are available to handle workpiece lengths up to 24", 48", 72", and 96". Various optional accessories include: Taper cutting attachment to mill any thread taper up to .100" per lead; automatic or manual facing attachment for turning shoulders and faces square with the thread pitch diameter; power positioning unit which moves the cutter head longitudinally to speed setup when handling a variety of part lengths; tailstock for external work; steady rest for 1" to 6" diameter parts.

For complete information and specifications, write for new Bulletin 620.

SINE BAR DIAL ADJUSTMENT, graduated in increments of .0002", provides any lead up to ½", including specials.



DIAL-ADJUSTED CUTTER HEAD. The cutter head is easily positioned and clamped longitudinally on the ways and transversely across the ways by dial adjustment.



INFINITELY VARIABLE FEED. During setup and automatic cycle, the feed is infinitely variable from 1/15 rpm to 6 rpm by adjustment of the feed control.

ADJUSTABLE CROSS TRAVEL. Total cutter head cross travel of 1-3/8" (including 3/8" max. feed) can be easily adjusted to the proper setting for any part.

SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

Report to the **SMTS*** *Committee*

*SPECIAL MACHINE TOOL STANDARDS

ACTIVATION: BUHR'S "BABY"

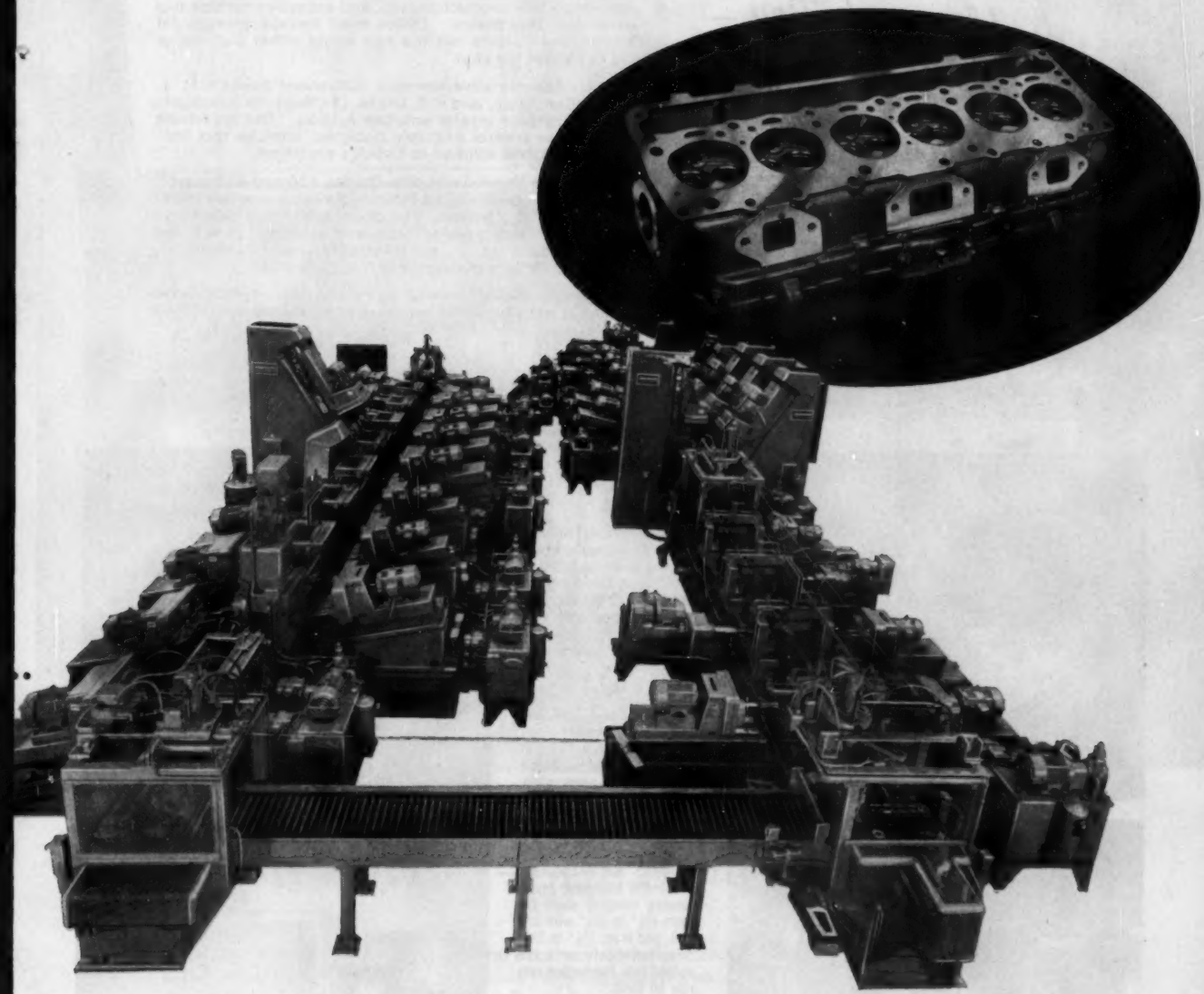
walks alone.....

Already assembled, tooled and running test parts! That's the latest word from American Motors Corporation, owner of Buhr's Baby.

The "Baby," as nearly everyone knows, is a lift-and-carry, part-through transfer—the first major transfer machine built to the new Special Machine Tool Standards. It was designed to perform 323 precision operations on cylinder heads for 1961 Rambler engines at the AMC plant in Kenosha, Wisconsin. Capacity at 100% efficiency is 120 pieces per hour.

And we are proud to announce that while the "Baby" was under construction, we started work on other Buhr Economatics to be built to the new Special Machine Tool Standards. To date, Buhr has built or is building its twenty-eighth additional "SMTS" machine.

BUHR MACHINE TOOL COMPANY • ANN ARBOR



BUHR

(say **BURE**)

ECONOMATIC®

MICHIGAN

Heavy Equipment Manufacturer

doubles production — cuts tool inventory 75%

with ADAMAS Carbide Products!

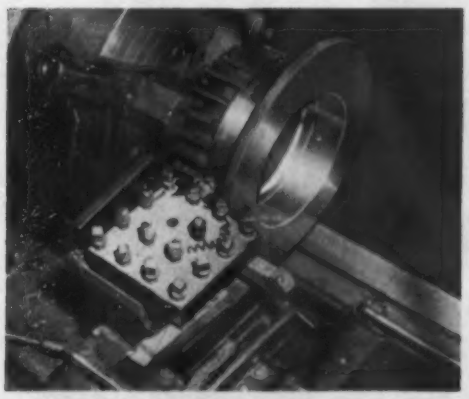
GET CONSISTENTLY HIGHER PERFORMANCES LIKE ESSICK

Two years ago Essick Mfg. Co., Los Angeles, was concerned with production lags, and excessive carbide tool costs and inventories. Essick tried various sources for inserts and holders but the tips would either pull out or fail to control the chip.

An Adamas advertisement influenced Essick's M. L. Taylor, Gen. Supt., and R. E. Drake, Div. Supt., to investigate Adamas carbide inserts and Dex-A-Tools. The adjustable chipbreaker control principle designed into the tool indicated a possible solution to Essick's problems.

Adamas Dex-A-Tools with Grades 434 and 548 inserts now handle practically all Essick applications with heavier feeds and higher speeds, and closer tolerances than those obtained with competing tools and inserts. Essick has reduced downtime . . . substantially increased output . . . lowered inventory of carbide and tools by 75%.

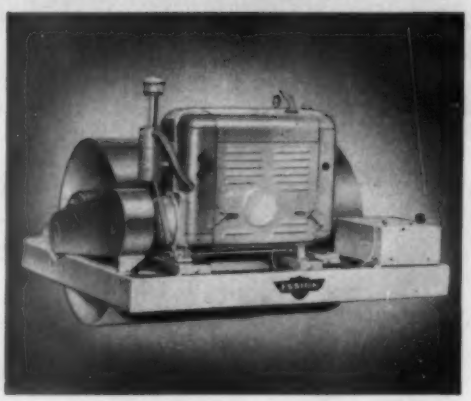
Roy Houck, District Manager — Adamas' Los Angeles office, furnished tool engineering assistance in the development of these applications.



ADAMAS Dex-A-Tool and Grade 548 triangular insert turning bearing housing 11.00" diam. This operation now takes 20 minutes . . . previous performance with competitive tools took 30 minutes. Time saved 33⅓%.

ADAMAS Dex-A-Tool and Grade 434 triangular insert turning vibrator shaft OD from 2⅜" to 1⅜" with one pass using a cross slide. Unit production rate rise 50-65%.

ADAMAS Dex-A-Tool and Grade 434 triangular insert turning vibrator shaft OD from 4⅛" to 3⅜" with one tool, and from 3⅛" to 2⅛" simultaneously with the second tool. Production rate rise 50-65%.



ESSICK Vibrating Compactor . . . One of the many pieces of heavy construction equipment machined with Adamas Carbide Dex-A-Tools and throwaway inserts.

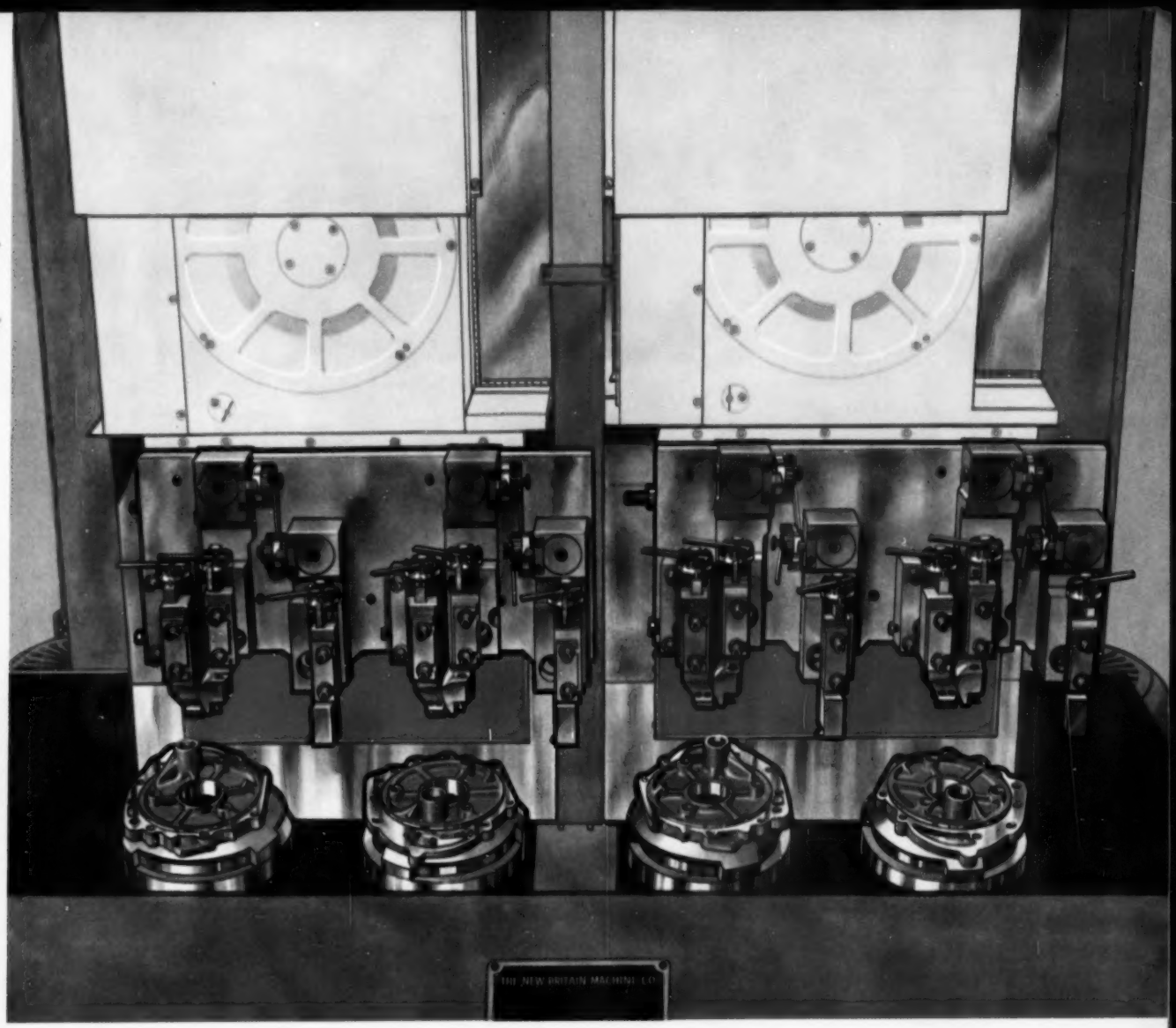
We would be glad to show you how Adamas Carbide products can help reduce your manufacturing costs. For more information, literature, and prompt engineering assistance, write direct to:

FREE — *Ask for your copy of New Adamas Price List PL-960*

Producers of Tungsten Carbide Tools, Tool Tips, Dies, Wear Parts, Dex-A-Tool, Dex-A-Mil

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

PROGRESSIVE CARBIDE USERS SELECT BY *Performance*—NOT HABIT!



precision boring–*New Britain's new approach*

New Britain Cam Actuated Vertical Precision Boring Machines offer an entirely new principle for more accurate boring and turning, plus compact exterior design and fast tooling. Rough cuts and finish cuts within close tolerances on the same set-up are characteristic. Standard models are available with maximum swing from 12" to 17¾" in 10 or 15 horsepower.

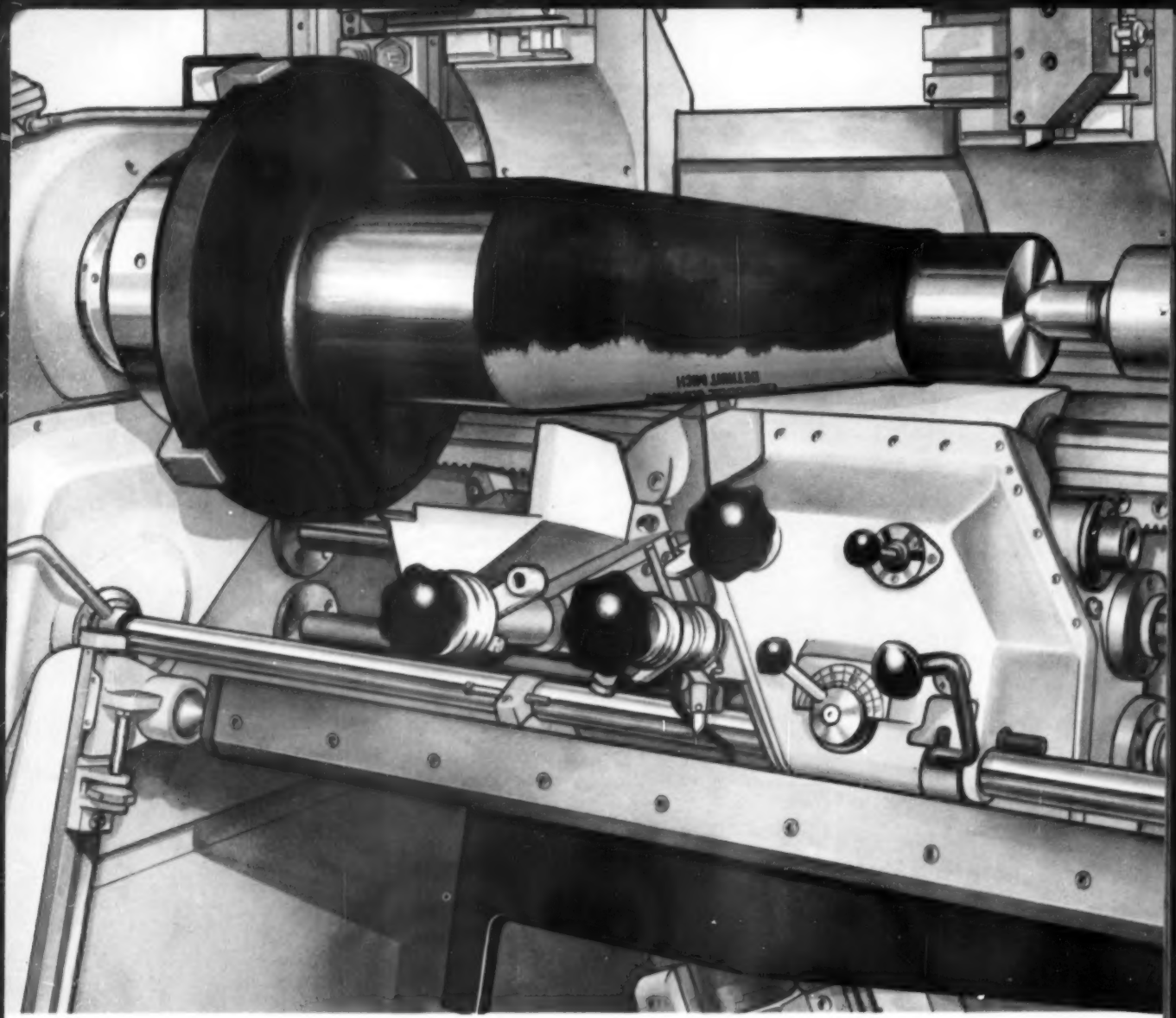
Here are a few of the major new developments incorporated in these unusual machines.

Greater accuracy. Both the vertical and cross slide cams are mounted on a common shaft which is contained inside the vertical slide. The linkages found in conventional cam-operated contouring machines are eliminated. Both the vertical and cross slides ride on preloaded roller bearings and are deflection-free.

Clean-sided design. Any number of these self-contained machines, each with one or more spindles, can be arranged side by side. Depending on how they are tooled, they operate either as a single unit or as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine, finishing both sides, completing *all* operations in one integrated, high-volume operation.

Fast tooling. Unrestricted accessibility allows rapid tool and cam changes.

Complete catalog material is available. For your copy, write New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

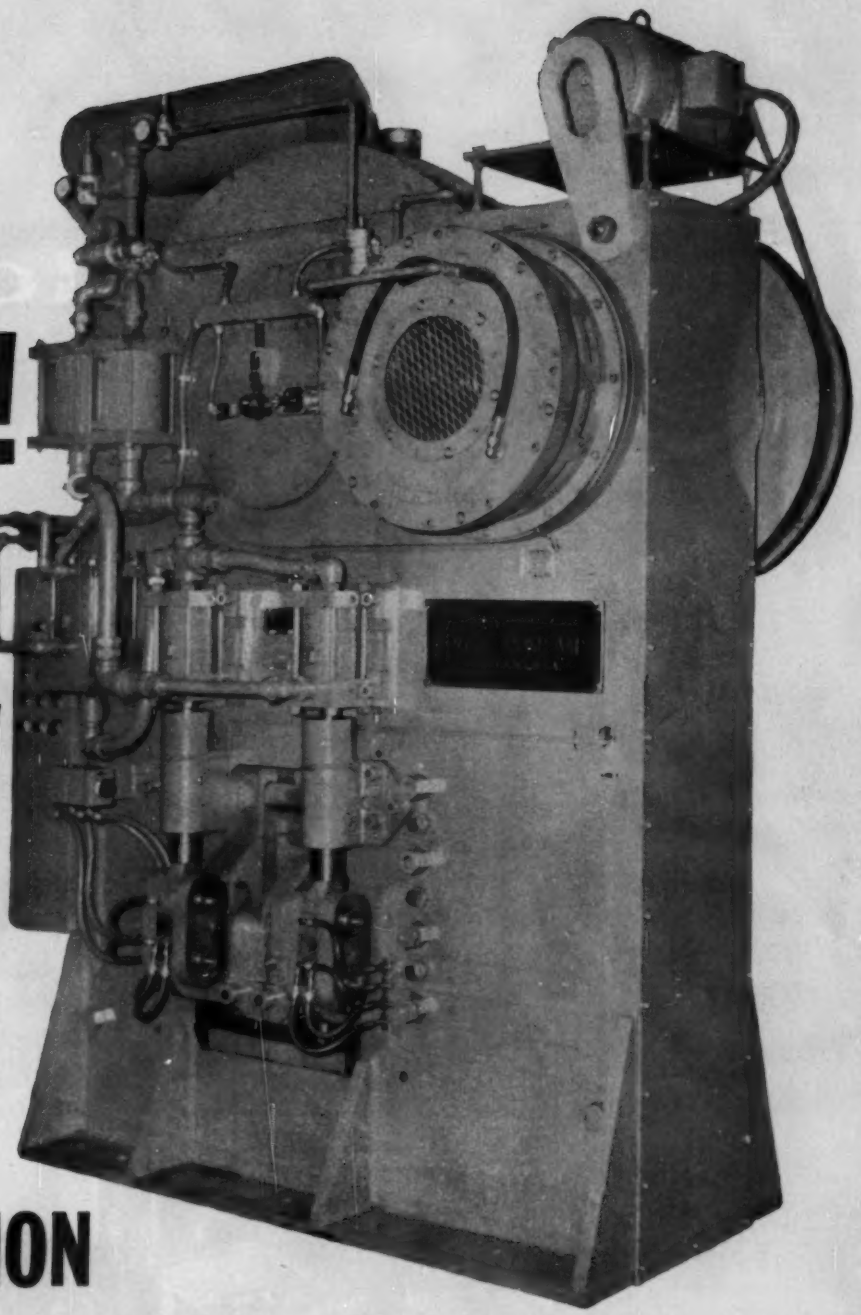


why a **copying lathe**–*why New Britain* **+GF+**

Beyond a certain point sustained production of the same piece on an engine lathe becomes uneconomical. Sometimes, however, the feeling exists that a copying lathe lacks flexibility, power and ruggedness or that it is just too "special." A New Britain **+GF+** has power—25 to 40 h.p. The **+GF+** has rugged design to handle big work and it's really flexible—a prototype or flat template will reproduce one or more pieces with fast, single point tooling. Whether it's shaft work or chucking work you have to do, ease of set-up is the same. The template or prototype can be changed in minutes. No special tooling set-ups are required, either. You can quickly switch from intricate cuts on slender shafts to heavy cuts on big castings or forgings (like the one shown). Complex profiling presents no problems even on jobs requiring really heavy metal removal.

Fast set-up and changeover from one type of work to another is only part of the story. There's much more that you'll want to know about the New Britain **+GF+**. Watching one of these machines in action is the best way to get the whole story and we'd like to arrange a demonstration for you. If you'd like to look over catalog material, we have that too, of course. Write New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

FAST!



'BUFFALO' 400 BILLET SHEAR

Up to 18,000 Cuts per 8 Hour Shift

THAT'S PRODUCTION

Discover how the *New* 'Buffalo' 400 Billet Shear can save time and boost production on your billet cutting operations. Contact your machine tool dealer, or write direct.

SPECIFICATIONS

Ram Tonnage	400 tons
Strokes per minute (free running)	60
Round Billets, Mild Steel	4½" dia.
Square Billets, Mild Steel	4" sq.
Flat Bars	12" x 2"
Knife Size	3" x 7½" x 13"
Motor Horsepower	20 HP Normal
Maximum Round or Square Size Without Modification	5" Sq. or Round
Machine Stroke	2"
Machine, Net Weight	32,000#
Length x Width x Height	80½" x 52" x 116½"

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

◄ CIRCLE 204 READER SERVICE CARD

CIRCLE 205 READER SERVICE CARD

HOW
MOBIL
HELPS

American Motors set

1

2

"The popular demand for Rambler Automobiles has resulted in sharply increased production requirements for our division. To keep our equipment running at capacity we have worked closely with Mobil Oil Company. This effort has been completely justified and has saved us considerable money."

MR. R. E. ANDERSON, *Superintendent, Motor Division, American Motors Corp.*

production records!

1. An annual change of hydraulic oil was once the rule for this large machine which broaches top and bottom of cylinder heads. Mobil engineers felt oil usage could be extended, performed periodic analyses that showed oil could be used three years. Examining oil sample is Anthony Belasich, Assistant Superintendent.

2. This "transfer line" machines cylinder heads. Subsequent washing operations were hampered by excessive "soaping" of the cleaner. Mobil traced the trouble to the cutting oil then in use, recommended an equally effective, but less costly product that solved the problem.

3. To meet production schedules, American Motors runs its engine division 24 hours a day at full capacity. Overload caused frequent breakdowns on the critical transfer machines that drill and ream cylinder blocks. Mobil recommended a correct heavy-duty lubricant, suggested periodic filtering of lubricant and hydraulic oil. Stoppages were drastically reduced. Discussing filtering procedure are Rudy Naiberg, Assistant Superintendent and Frank Zuerner, Mobil Representative.

American Motors Plant at Kenosha, Wisconsin, fills increased production demands... reduces downtime... cuts labor and material costs!

Keep 'em coming! That's the order of the day for Rambler Automobiles, and production stoppages can be disastrous. When American Motors' far-sighted management anticipated production demands that would greatly exceed rated plant capacity, they promptly went about making preparations. Mobil was called in to insure correct lubrication for the highly critical production machinery in the motor division.

Mobil engineers, working in close cooperation with American Motors personnel, analyzed the lubrication problems posed by this record output . . . studied other problem areas as well. They recommended correct heavy-duty products, effective preventive maintenance procedures, techniques to reduce contamination and prolong lubricant life. As a result, machine downtime was greatly reduced, production availability sharply increased, and direct dollar savings to American Motors were achieved.

If you are interested in how Mobil may help you solve lubrication problems in your plant, call your nearest Mobil representative. Or write: Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

Mobil

CORRECT LUBRICATION

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

CIRCLE 206 READER SERVICE CARD

TO MAKE SURE A TWIST DRILL'S CUTTING EDGES ARE SHARP AND CLEAN, an inspector measures its chisel angle, point angle and lip relief under the powerful lens of a precision instrument. Continually-improved Rex High Speed Steels help produce the fine edges so essential in twist drills.

MORE HOLES PER DRILL *Today's twist drills meet new standards for hardness, toughness and strength– because of continually improved Rex® High Speed Steels.*

Drills, the most heavily loaded cutting tools in metalworking, are now meeting even more exacting requirements. A matter of economics accounts for the new standards: because, *the profitability of the automated equipment in which the drills are being used depends solely on their performance.*

Twist drills that meet customers' strictest specifications–for hardness and toughness, for strength and precision–are being produced right now. They're available because of the drillmakers' continuing research and skill – combined with Crucible progress in making better high speed steels.

TWIST DRILLS made of Rex High Speed Steels consistently meet the drillmakers' exacting tests for hardness.

To produce the fine steels needed for twist drills, Crucible tool steel specialists now use the most advanced electronic instrumentation available. For example: they can record the temperature of the molten metal in the melting furnaces within 5 seconds. So, each heat is produced under identical temperature conditions.

Crucible specialists employ new techniques that also greatly improve deoxidation of the liquid steel. They use new ingot mold designs to minimize segregation. And they ultrasonically inspect every billet of Rex High Speed Steel before rolling or forging to ensure freedom from internal voids, flake, inclusions, etc.

For complete information on how Rex High Speed Steels can help make precision tools better, call or write the Crucible branch office or service center near you.

BETTER TOOLS, THROUGH BETTER STEELS. Constant improvement of Rex High Speed Steels ensures the increasingly better performance of hobs, taps, broaches and cutters — as well as twist drills.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Caldwell, New Jersey • Charlotte Chicago • Cincinnati • Cleveland • Columbus • Dallas • Dayton • Denver • Detroit • Erie, Pennsylvania • Grand Rapids • Houston • Indianapolis Los Angeles • Miami • Milwaukee • Minneapolis • New Haven • New York • Philadelphia • Pittsburgh • Portland, Oregon • Providence Rockford • Salt Lake City • San Francisco • Seattle • Springfield, Massachusetts • St. Louis • East Syracuse • Tampa • Toledo • Tulsa

CIRCLE 207 READER SERVICE CARD

90 STANDARD SIZES

in a Custom-Quality Press

Take your choice of dependable Danly SC crankshaft presses in capacities from 50 to 300 tons...bed areas to 72" x 60"...with strokes to 16"...constant or variable speeds to 90 SPM... with non-geared, single or double-geared drives...equipped for manual or automatic feed.

Every SC press gives you Danly's patented low-maintenance air-friction clutch, husky welded-steel frame, and countless other custom-quality features.

For low-cost piece part production ...in blanking, drawing, piercing, forming, or progressive die stamping... you'll find your choice of Danly SC Presses ahead of the field and best for you. WRITE FOR NEW SC CATALOG and get all the details.

DANLY

DANLY®

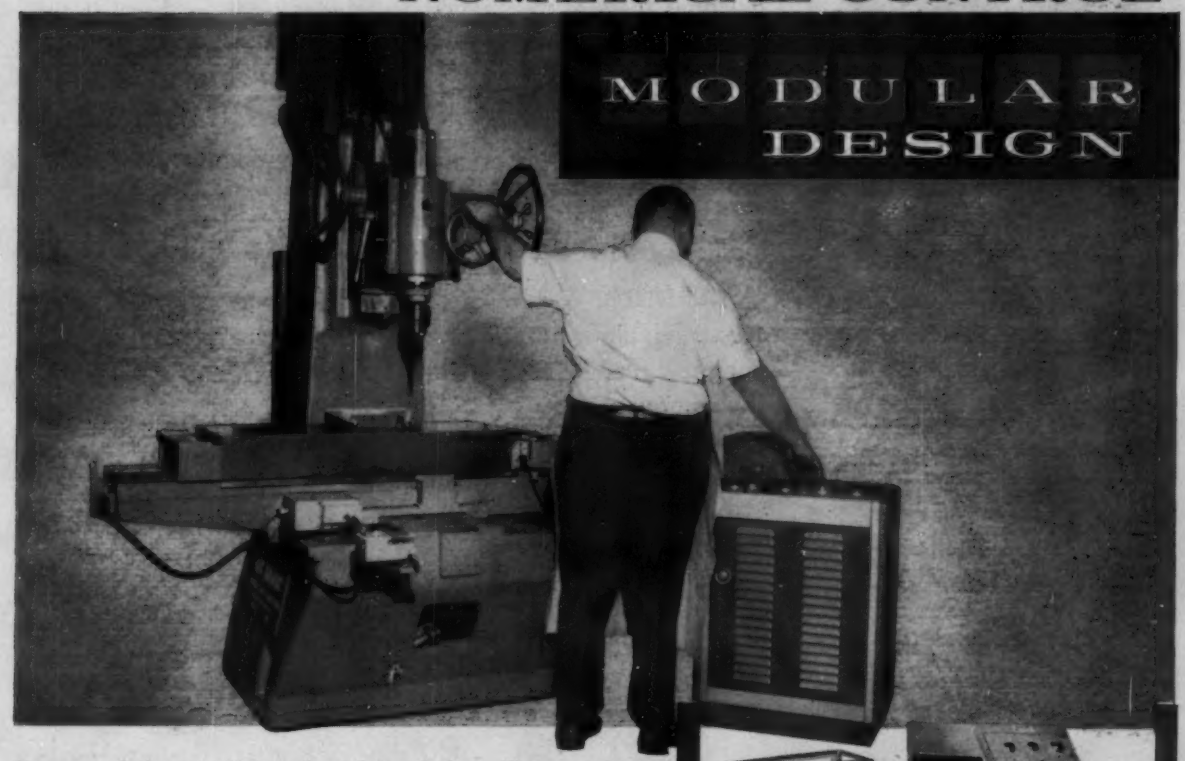
DANLY MACHINE SPECIALTIES, INC., 2100 S. LARAMIE AVE., CHICAGO 50, ILLINOIS

Reduce costs of...

Maintenance
Labor
Downtime
WITH

SINGER*

NUMERICAL CONTROL



Because of the simplicity of modular design, all components within the Singer Numerical Control can be quickly and easily removed, replaced or modified.

Modular design is not the only outstanding feature of Singer Numerical Control. The high degree of accuracy is made possible by a division of the measuring section and the motor drive within the system. Accuracy of ± .001 inches on a work table with as much as 40 inches motion is another . . . increased accuracies up to ± .0002 inches are available with further refinement of the system, where compatible with the machine tool.

Singer Numerical Control Modular Design represents the most straight-forward approach to point-to-point positioning yet conceived. It offers the simplicity, reliability and economy necessary for the efficient operation of machinery.

You are invited to visit the demonstration room at Diehl Manufacturing Company's Finderne, New Jersey plant to see the Singer Numerical Control in operation and to examine actual production records. Write for the Singer Numerical Control Brochure.

Module Rack (left) contains seven easily-removed modules—the basic components of the Singer Numerical Control System—and is housed within the main Control Console. Separate modules are easily accessible and the entire Module Rack may be rolled out from the Console on the self-contained tracks. Two types of Console Cabinet are available: the smaller NEMA 1 Cabinet (at operator's hand above) and NEMA 12 Cabinet (to right of Module Rack).

†A Trademark of THE DIEHL MANUFACTURING COMPANY
*A Trademark of THE SINGER MANUFACTURING COMPANY

Diehl†

DIEHL MANUFACTURING COMPANY
SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY
Somerville, New Jersey

-2361-

ARMSTRONG
TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

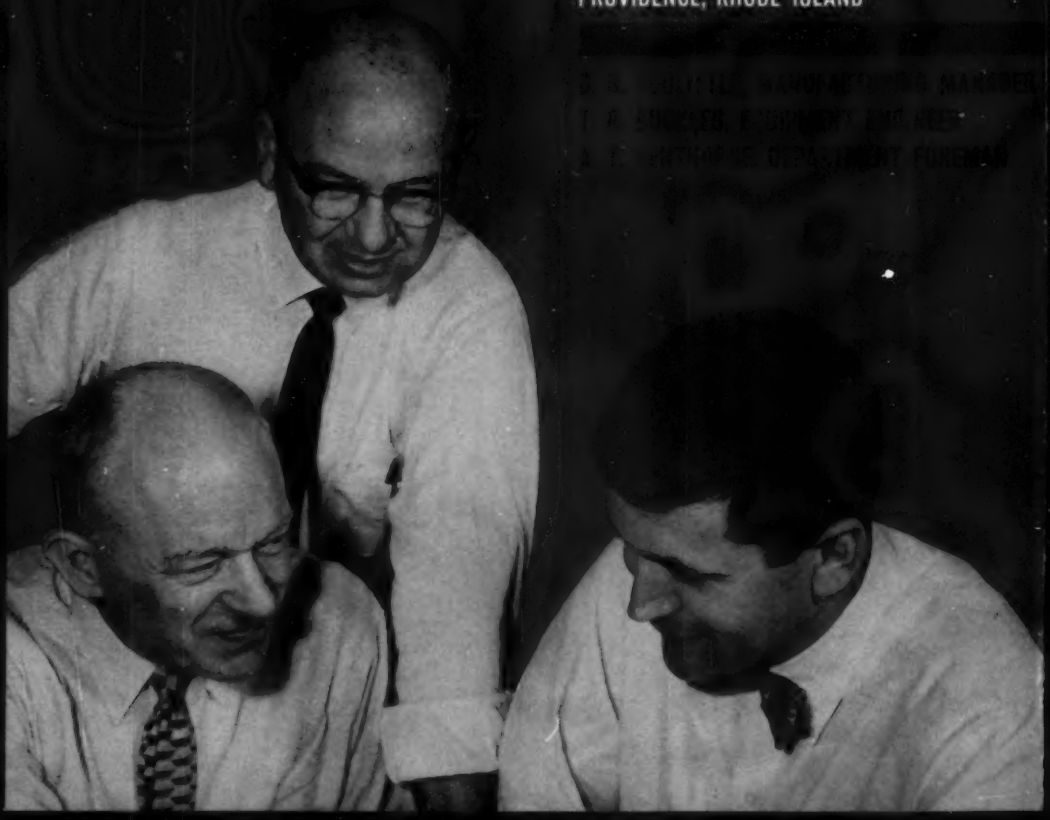
If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

HOW GIDDINGS & LEWIS NUMERIPOINT CONTROL CHANGES
THE ECONOMICS OF SHORT-RUN PRODUCTION AT BROWN & SHARPE

JIGS & FIXTURES "TRADED" FOR GIDDINGS & LEWIS TAPE-CONTROLLED MACHINING... EXPECT PAY-OFF IN FOUR YEARS

THE TEAM THAT EXPANDED THE USE
OF TAPE AT BROWN & SHARPE MFG. CO.
PROVIDENCE, RHODE ISLAND



MACHINE TOOL BUILDER CHALKS
SAVINGS IN A YEAR WITH GIDDIN
NUMERIPOINT*-CONTROLLED HORIZ

**TAPE CONTROL PROVES IDEAL FOR SHORT-LOT PRODUCTION — MACH
25 TO 50% AND HIGHER — ACCURACIES ARE IMPROVED — TOOLING**

Brown & Sharpe are machining to accuracies of ± .00025" with this Numeripoint-con
simply changes tools. A digital dial control system also enables the operator to positio
for occasional parts which have not been programmed for tape.

GIDDINGS & LEWIS

KS UP $44,954
DINGS & LEWIS
ORIZONTAL

MACHINING TIME SAVINGS RUN
OLING SAVINGS ARE MAJOR

int-controlled horizontal. The operator
position the machine with pushbuttons

Any manufacturer producing machinery in lot sizes too small to justify full-scale mass production approaches can visualize the values of tape-controlled machining through the experience of Brown & Sharpe Mfg. Co., Providence, Rhode Island.

During a year of operation of its G&L tape-controlled horizontal, this precision machine tool builder experienced machining time savings of $8,594 on the parts illustrated at the right. On the same parts tooling savings were $36,000.

Payoff period only four years. According to the Brown & Sharpe group pictured on the front of this folder, results have substantially exceeded the machine justification. Complete pay-off in only four years is expected.

They also report that programming has been readily mastered. No special skills or capabilities have been required; a knowledge of part layout and job setup is all that is necessary to prepare data. Programming and preparation of tapes for many jobs can be done within several hours.

Tons of jigs eliminated. Economic justification for the Numeripoint-controlled G&L was an open and shut case when Brown & Sharpe faced the cost of tooling for production of a new line of machines. It quickly was determined that the tons of jigs and fixtures required could be "traded" for the new tape-controlled machine. Added advantages of tape: greatly reduced lead time, freedom to modify design almost at will because of the moderate cost involved, reduced handling, lower unit production cost, improved accuracy, and reduction in human error.

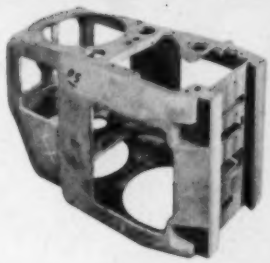
Giddings & Lewis tape-controlled machine tools in use today are providing competitive advantage for manufacturers of power generation equipment, printing presses, construction machinery, machine tools, transportation equipment, aircraft, valve specialties, dies, and other products.

Ask for details. The benefits of tape control are proved and ready for your company. For complete information and cost analysis, consult your local G&L distributor or write:

GIDDINGS & LEWIS

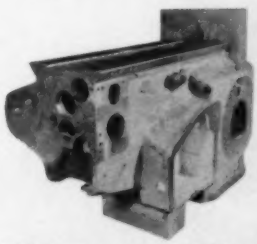
Giddings & Lewis Machine Tool Company, Fond du Lac, Wis.

* Numeripoint is the G&L trade-mark for its punched tape discrete positioning system.

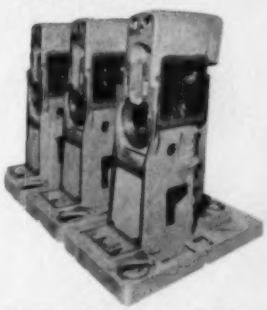


40% time savings in machining heads for turret drilling machines.

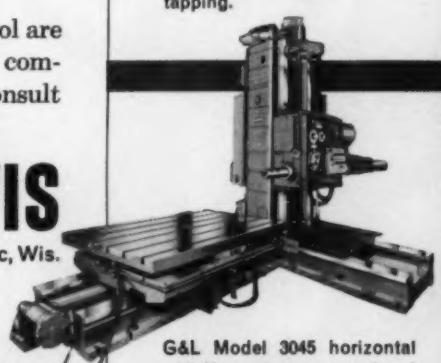
28% savings in unit hours on this upper column for turret drilling machines.



42% savings in production time on this milling machine knee principally through reduction in handling.



50% savings in production time on these milling machine stands — milling, rough and finish boring, drilling, and tapping.



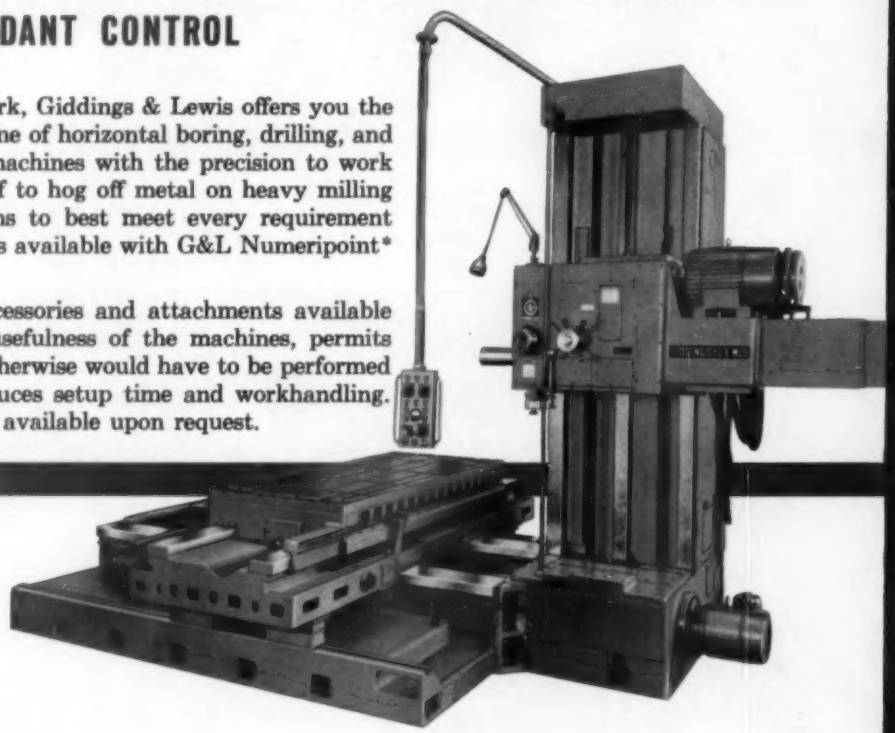
G&L Model 3045 horizontal with Numeripoint control and rotary table.

GIDDINGS & LEWIS HORIZONTALS

TO MEET EVERY MANUFACTURING REQUIREMENT NUMERIPOINT* OR NUMERIPATH* TAPE CONTROL . . . TRACER . . . DIGITAL DIAL CONTROL . . . PUSHBUTTON PENDANT CONTROL

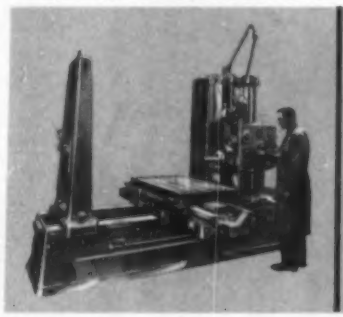
For production or toolroom work, Giddings & Lewis offers you the most extensive and advanced line of horizontal boring, drilling, and milling machines available — machines with the precision to work to close tolerances and the beef to hog off metal on heavy milling cuts. There are control systems to best meet every requirement and every machine in the line is available with G&L Numeripoint* or Numeripath* control.

The most extensive line of accessories and attachments available greatly extends the range of usefulness of the machines, permits combining of operations that otherwise would have to be performed on different machines, and reduces setup time and workhandling. Complete descriptive literature available upon request.

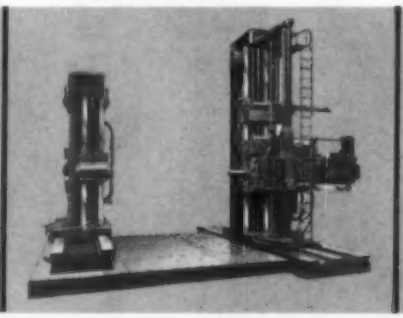


This all-new G&L horizontal, available with 5" or 6" spindle, includes full pendant control of all machine functions, massive 3-way column, motorized headstock, joy-stick control of milling feeds, many other exclusive features. Ask for Catalog No. H6T.

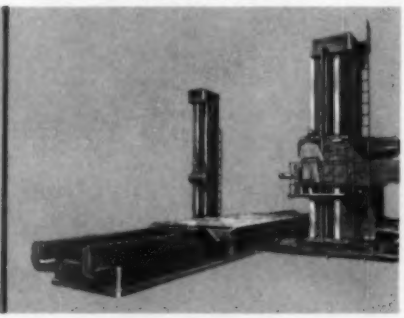
Table type — 3 to 8" spindle diameters — 10 to 75-hp main drives.



Floor type — 4 to 14" spindle diameters — 20 to 150-hp main drives.



Planer type — 4 to 14" spindle diameters — 20 to 150-hp main drives.



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*G&L Trade-mark

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ELMIRA, N.Y.

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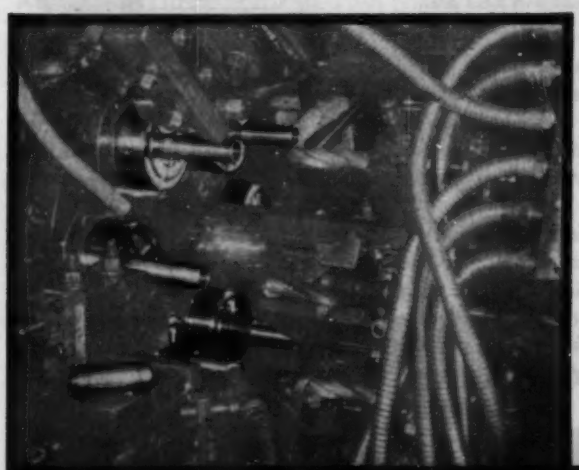
Photo of Model 601 New Britain Automatic courtesy New Britain-Gridley Machine Division.



Your automatics perform best with HARDINGE Master Feed Fingers and Master Collets. The name HARDINGE is your guarantee of accuracy and durability . . . allows you to reap the full benefit of the inherent accuracy of your machines.

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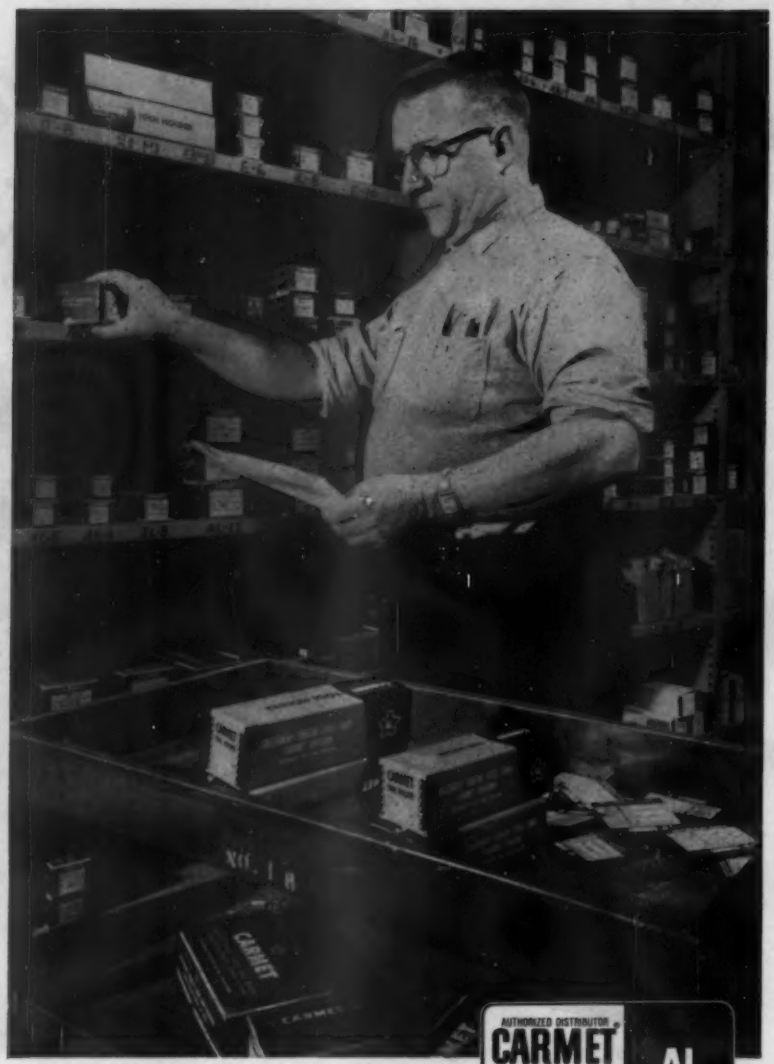
Off-the-shelf delivery of Carmet® Carbide Tools from your local CARMET Distributor



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And if you get in a production jam, special service is his middle name. Remember, your Carmet distributor knows carbide tooling—with the help of the local Carmet technical man, you get all the help you need.

Your Carmet distributor handles the best Carbide Tools and backs it with the best service! ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.***

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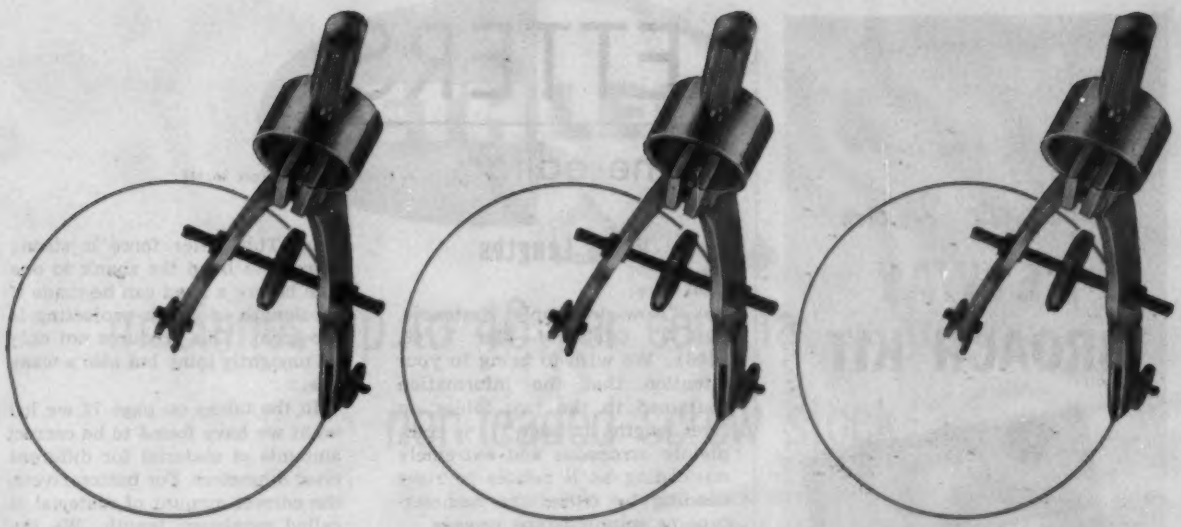

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LETTERS

to the editors

330 W 42nd St, New York 36, NY

Rivet Lengths

Dear Sirs:

Re: "How to Apply Fasteners, Part 2" (*AM/MM*—Mar 7 '60, p106). We wish to bring to your attention that the information contained in the two tables on rivet lengths on page 111 is completely erroneous and extremely misleading as it relates to rivet heading by either the hammer-type or spinning-type process.

We have manufactured both rotary vibrating riveters and noiseless rivet spinning machines for 50 years and more, so we feel we speak with assurance in our criticism.

Lest we be misunderstood, however, let us say that "Length B" as listed in Mr Paquin's tables may be perfectly proper for impact heading. Machines for forming heads by this process we are not familiar with, and therefore we will refrain from comment in that connection.

. . . In both the [hammer and spinning] processes there is not only a strong force applied vertically down on the rivet shank, but there is also a strong force applied radially outward from the axis. This latter force is strong enough to bend the shank to one side before a head can be made if the length of shank projecting is too great. This produces not only an unsightly joint but also a weak one.

In the tables on page 72 we list what we have found to be correct amounts of material for different rivet diameters. For button rivets, the correct amount of material is called *maximum length*. We say maximum for two reasons: 1) not everyone is interested in the strongest possible head, and 2) the maximum amount of material does not necessarily form the strongest head. Affecting the strength of the riveted head are also the shape of the head and the completeness of the head.

For flush rivets, the correct amount of material is called *length* without any reference to a maximum. The length specified must be used as a general guide only, because variations in countersink angles and depths can make a difference in the amount of material required to start with.

We sincerely hope that this presentation will reduce the con-

SHOPMATES

N. Jarvis

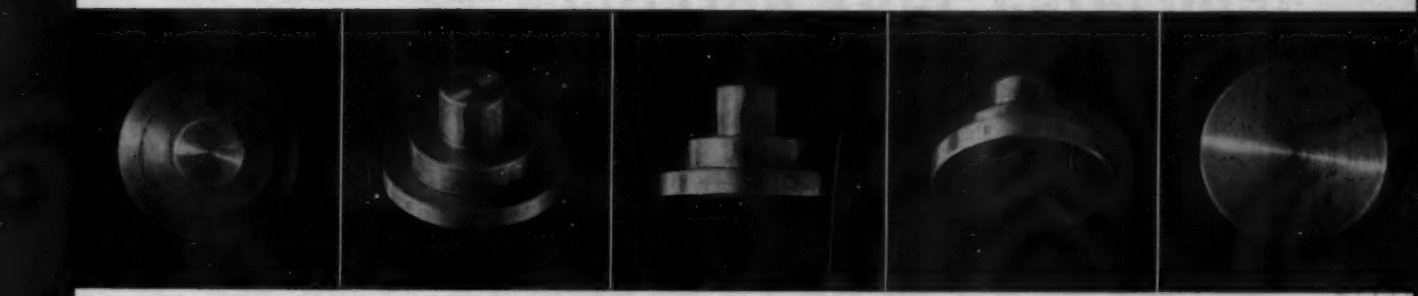
I CAN'T REMEMBER WHY I ASKED YOU TO COME TO THE OFFICE ... HAVE YOU ANY IDEA WHY? WHAT ELSE DID I SAY? WHAT WERE YOU DOING AT THE TIME?
WELL ... WHAT I WAS DOIN' WAS THINKIN' ABOUT A RAISE !!
THE WHIP PULLS THAT ONE TO FIND OUT WHAT GOES ON BEHIND HIS BACK!
NOW HE'LL BE ALL PREPARED IN CASE WE HIT HIM UP FOR MORE DOUGH!
N. Jarvis

machines up to 40 per cent faster than non-leaded screw stock

Here's a screw-stock steel that'll really set your bar automatics humming. And your profits soaring. It's Bethlehem's newest free-machining steel, Beth-Led.

This high-sulfur, leaded carbon screw-stock machines from *20 to 40 per cent faster* than comparable steel grades which do not contain lead. Beth-Led increases production without sacrificing tool life. Chip control is excellent. And it machines to a satin-smooth finish.

Beth-Led is available either hot-rolled as produced by Bethlehem, or cold-finished as distributed by non-integrated cold drawers. Call our nearest sales office for the details.



Steel

for Strength
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Part: Rivet
Screw Stock: ½-in. BETH-LED round
Chip removal: 72 per cent
Cutting speed: 294 SFM—up 36.8 per cent*
Production rate: 2330 pieces/hr—up 33.1 per cent*
*over the control stock: C-1213 non-leaded steel

Bethlehem Steel Company, Bethlehem, Pa. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Announcing the Van Keuren
THREAD RING COMPARATOR

It does the job FASTER and EASIER than rings AT LESS COST

If you use THREAD RING GAGES in your production line, the new VAN KEUREN THREAD RING COMPARATOR will dispense with many gages and much labor cost — in providing quick, accurate and repetitive measurements.

The Van Keuren Thread Ring Comparator is a production gage for checking external threads up to ¾" diameter.

Gages both full form and pitch diameter • Sets and checks quickly

Gives uniform results. Repeats to .0002" • Long lasting — has no pivots

Write for descriptive literature or call your nearest Van Keuren representative for demonstration. Literature is available covering our full line of Thread Gages and other measuring equipment.

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PRECISION MEASURING TOOLS
. . . rated the world's most accurate

Plug Gages • Measuring Wires • Optical Flats and Light Wave Equipment • Gage Blocks
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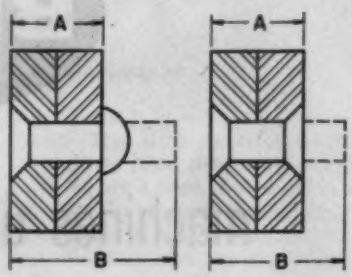
fusion that has been existant in our industry for some time.

W Bruce McNaughton, president
The Grant Mfg & Machine Co
Bridgeport, Conn



Rivet Lengths

Rivet dia	Buttons Rivets Max length (B-A)	Flush Rivets Length (B-A)
1/8	1/8	3/64
3/16	3/16	1/16
1/4	3/16	1/16
3/8	1/4	3/32
1/2	5/16	7/64
5/8	5/16	9/64
3/4	5/16	5/32

Mr Paquin, the author, replies: The values given in my tables were not intended to apply to all reveting operations. When taken in context, they clearly apply only to those riveting operations performed in building certain types of dies.

No more than two or three rivets are ordinarily involved, and such riveting is done with a hand rivet set and sledge. As the work is performed by a skilled diemaker, considerably more material can be allowed than for machine riveting on a production basis.

Flat-head riveting is done by peening with the round end of a ballpeen hammer. After riveting, any excess metal is removed by machining to provide a flat surface.

However, the table contributed by Mr McNaughton should be of value to users of vibration riveters and rivet-spinning machines.

"Why do you keep trying to make both ends meet? Who wants to travel in a circle?"

CALENDAR

American Welding Society—National Fall Meeting, Sept 26-30, Penn Sheraton Hotel, Pittsburgh, Pa.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 26-30, Coliseum, New York, NY.

Pressed Metal Institute—Annual Meeting, Oct 10-14, Shawnee Inn, Shawnee on Delaware, Pa.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 10-14, The Ambassador, Los Angeles, Calif.

Industrial Management Society—Industrial Engineering and Management Clinic, Oct 13-14, Conrad Hilton Hotel, Chicago.

National Safety Council—National Safety Congress, Oct 17-21, Conrad Hilton Hotel, Chicago, Ill.

Magnesium Association—Annual Convention, Oct 17-18, Hotel Carter, Cleveland, Ohio.

American Society for Metals—National Metal Exposition and Congress, Oct 17-21, Trade and Convention Center, Philadelphia, Pa.

National Tool & Die Manufacturers Association—Annual Convention, Oct 19-23, Leamington Hotel, Minneapolis, Minn.

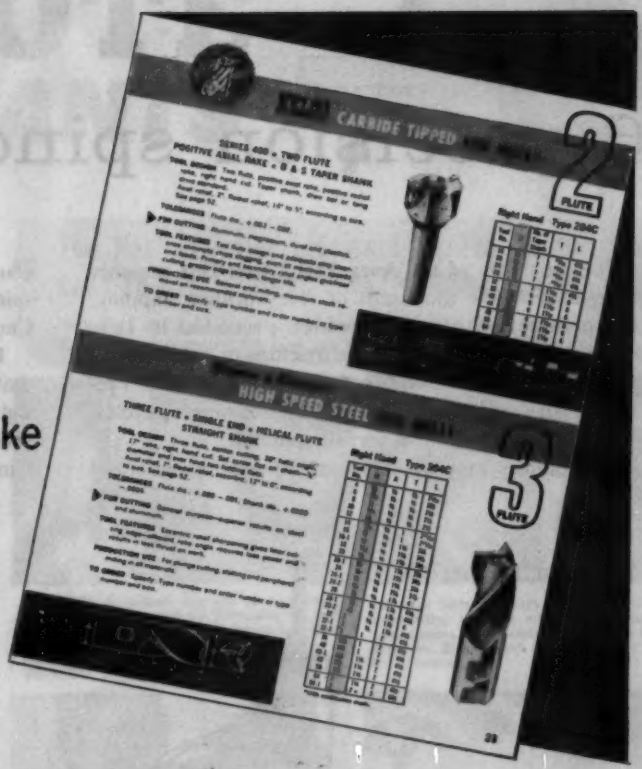
American Gear Manufacturers Association — Semi-annual Meeting, Oct 24-26, Edgewater Beach Hotel, Chicago, Ill.

Material Handling Institute—Central States Show, Nov 8-10, Kentucky Fair and Exposition Center, Louisville, Ky.

American Society of Tool & Manufacturing Engineers—Western Tool Show and Convention, Nov 14-18, Sports Arena, Los Angeles, Calif.

American Society of Mechanical Engineers — Winter Annual Meeting, Nov 27-Dec 2, Statler Hilton Hotel, New York, NY.

Society of Automotive Engineers—International Congress and Exposition, Jan 9-13, Cobo Hall, Detroit, Mich.



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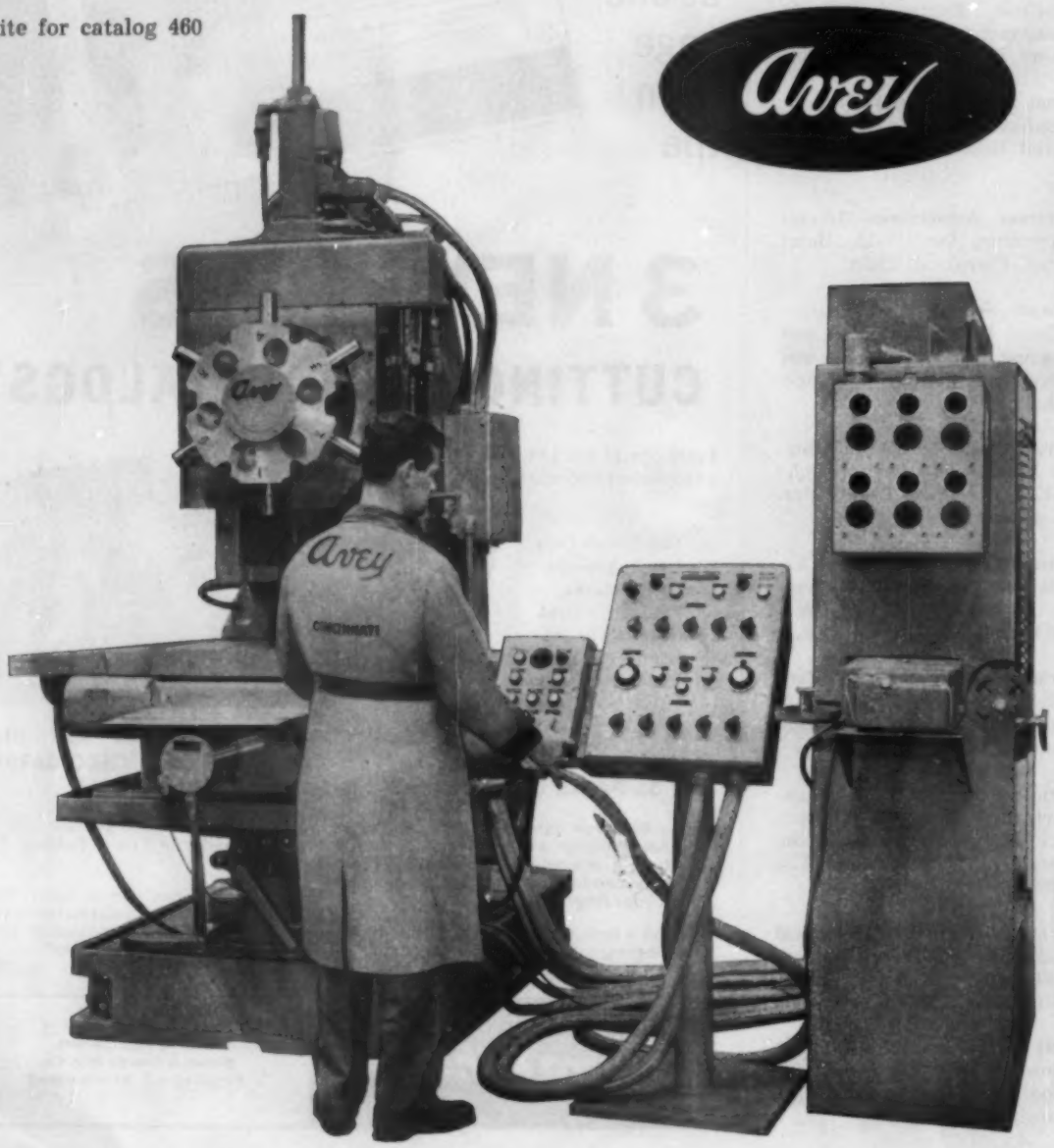
The reliability of the Avey 250 Turret-Dex matches the quality of the thousands of Avey drilling, tapping, and production machines which preceded it. It is available as either an automatic machine or numerically-controlled with rotary or two-axis positioning table. Pre-selected speeds, feeds, rapid advance, and tapping cycles. Automatic depth control for all spindles.

All spindles may be skip indexed. Automatic turret clamping. Positive spindle location. Rigid one-piece spindles, mounted in "O" precision taper roller bearings. Capacity up to 1¼" in steel.

The Avey Turret-Dex makes it more clear than ever that, for your drilling requirements, "Avey makes the right one for Avey makes them all." The Avey Division, Motch & Merryweather Machinery Co., Box 1264, Cincinnati 1, Ohio.

Write for catalog 460

Avey



MOLYKOTE® LUBRICANTS type G

Industry's NEWEST Production TOOL

Every machine shop foreman remembers when a can of some solid lubricant (usually a dispersion of white lead) was present on every machinist's and every maintenance man's workbench.

When galling and seizing began to develop in such equipment as lathe centers and steady rests, on threaded connections, in cutting threads, or in the assembly of parts . . . white lead was added to the regular lubricant.

MOLYKOTE G handles these and many more tough lubrication jobs more effectively. It is an essential manufacturing tool. In fact, no single, low-cost tool in any plant today can save as much money in manufacturing operations as MOLYKOTE G.

NOW AVAILABLE

New applicator jar

(10 ounces)

- No contamination of lubricant or applicator brush
- No soiled hands or clothing
- Shock resistant plastic container
- Handy size for bench or tool kit
- Applicator integral part of cap

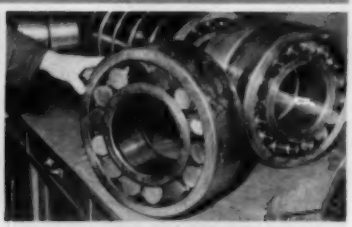
ALSO AVAILABLE IN:

- The 7/10 ounce tube
- The 2 ounce tube
- The 1 lb. can (½ pint)
- The 4 lb. can (quart)
- The 15 lb. can (gallon)
- The 30 lb. drum (5 gallons)

The Most Effective Lubricant On The Market Today
EASY-TO-USE • PRACTICAL • HUNDREDS OF USES

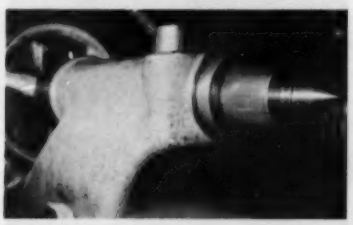
Here are a few examples of applications in which MOLYKOTE G excels. Obviously, the list is not complete. Try it on your toughest lubrication jobs.

MOLYKOTE G rubbed into the solvent-cleaned surface of bed and wiped dry. Eliminates bed wear and chatter. More effective than large quantities of oils and greases. Chips and filings do not adhere when surface has been treated with MOLYKOTE G.



In large roller bearings MOLYKOTE G makes press-fitting easy. No metal pick-up; no distortion. Insures proper seating. Eliminates fretting corrosion. Simply brush MOLYKOTE G on ID and OD of bearing.

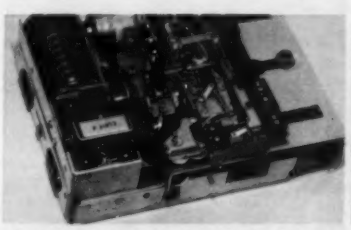
No "freezing" of threaded connections when treated with MOLYKOTE G. Uniform torque. No galling and seizing. Also ideal where extreme temperatures or chemical atmospheres are part of operating conditions. Most effective thread lubricant made today!



Lathe centers and steady rests are plagued with galling, metal pick-up and need for frequent lubrication. Just brush MOLYKOTE G on tip of lathe center. Lasts 3 or 4 times as long as conventional lubricants.

Industry has recognized effectiveness of MOLYKOTE G in preventing fretting of splines in power transmisson shafts. Allison Div. (GMC) and Mercedes-Benz recommend it for this use.

The second lobe on the cam shaft in above photo is worn almost round. Failure occurred after a few hundred miles. When lobes were treated with MOLYKOTE G before assembly, failures were reduced to a negligible number.

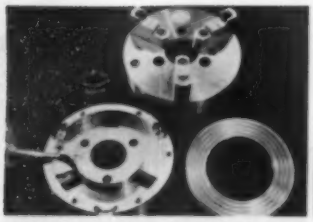


Small mechanisms and sub-assemblies in equipment such as this dictating machine can cause expensive down-time and service calls. By brushing MOLYKOTE G on troublesome parts before assembly a substantial reduction in maintenance was realized.

This is a drive shaft and gear of a Banbury Mixer. The gear is press-fitted on the shaft. After MOLYKOTE G was used in the press-fitting, there was no galling during assembly and ease of subsequent removal after operation was assured.

THE ALPHA-MOLYKOTE CORPORATION

65 Harvard Ave., Stamford, Conn. • Cable Address: MOLYKOTE-STAMFORD • Fireside 8-3724
Factories: Stamford, Conn. • Munich, Germany • Strasbourg, France

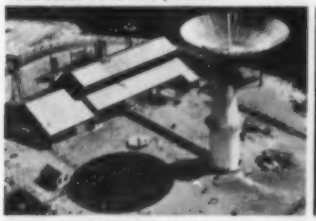


MOLYKOTE G used on the hub surface and internal moving parts of chucks eliminates galling and substantially reduces wear. The clamping pressure is often doubled due to the reduction of internal friction.

Engineers in Germany designed a new bridge for the Mangfall Valley. Existing traffic had to be accommodated. During construction, the bridge builder used MOLYKOTE G to "slide" the 4400-ton existing bridge to a new position 60 feet away.

These punches were used to punch holes in ½" #1020 cold rolled steel plate. Without MOLYKOTE G the punches could produce only 2000 acceptable holes. After using MOLYKOTE G occasionally during the operation 25000 holes were punched.

This is the valve manifold of a crude oil sampler. It lay at the bottom of a salt water hole for two years at 78°C. After this time the center portion was corroded badly, but the threads at right which were treated with MOLYKOTE G were perfect.



A 10' dia. ball bearing supports this radar tracking unit. An internal ring gear is driven by four 100 hp motors. After 1 hour of operation, the teeth were badly galled. MOLYKOTE G solved the problem.

As a protection to threads and to insure proper metal-to-metal fit in a critical area, MOLYKOTE G is applied during assembly to the threads of cap screws holding the flywheel to the crankshaft of 6-cylinder Caterpillar Diesel engines.

DON'T ACCEPT IMITATIONS

Just because a lubricant contains molybdenum disulfide is no proof of superiority. Its addition to a lubricant can be extremely effective, but also it can be quite ineffective and even damaging for lack of purity. The term "Molybdenum Disulfide" applies to the mineral and does not refer to its purity, state of decomposition or particle size—all of which affect its functional properties as a lubricant.

Its lubricating effectiveness is further affected by particle size distribution and other ingredients in the finished product.

Effective compounding is impossible without extensive laboratory controls and testing facilities.

MOLYKOTE, the original molybdenum disulfide lubricant, could never have attained world fame just because it contains molybdenum disulfide. The effectiveness of MOLYKOTE Lubricants is mainly based on continuous research, development and testing. Our testing laboratories are judged among the world's best equipped for Boundary Lubrication, Friction and Wear. We encourage visits to our laboratories.

CLEANING UP AFTER USING MOLYKOTE G LUBRICANT IS NO PROBLEM . . .

Simply follow these two instructions:

1. Before working with MOLYKOTE G rub a protective cream on the hands and under the finger nails. (Pro-Tek®, Go-Jo® Protective Skin Coat, West Protective Cream #211, and Gre-Solvent® Protective Cream are good for this purpose.)
2. To clean the hands use Gre-Solvent®, Cope®, or Go-Jo®. A hand brush will help remove any MOLYKOTE G from under the finger nails. Mild soap will remove it from the face.

Note: Work clothes soiled with MOLYKOTE G can be laundered in home washing machines. Dress clothing soiled with MOLYKOTE G should be dry cleaned.

FIVE TREMENDOUS ADVANTAGES

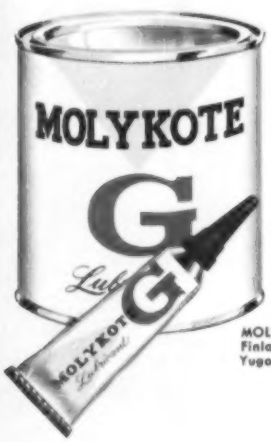
- **Almost 100% safety against galling and seizing with all bearing-metal combinations.**
- **Eliminates "stick-slip", metal pick-up and distortion in press-fitting.**
- **Reduces wear-in time and damage in new or rebuilt machinery.**
- **Works most effectively beyond the range of conventional lubricants.**
- **The higher the loads the greater the superiority of MOLYKOTE G.**

MOLYKOTE G IS ECONOMICAL: *EASY-TO-USE*

Because of its excellent lubricating qualities, MOLYKOTE G Lubricant need only be used in small quantities. Follow this simple three-step procedure.

1. Wherever practical, clean the part to be lubricated with a solvent.
2. Rub MOLYKOTE G Lubricant on the bearing surface. Use brush or clean rag.
3. Wipe off excess MOLYKOTE G Lubricant.

NOTICE: Decals are available to all original equipment manufacturers for use on machines which should be lubricated with MOLYKOTE Lubricants in actual operation. These decals can be manufactured to your specifications. Write our Technical Service Department for details.



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MOLYKOTE Lubricants are also distributed in the following countries: Argentina, Australia, Austria, Belgium, Canada, Denmark, England, Finland, France, Germany, Greece, Holland, India, Israel, Italy, Japan, Norway, Portugal, Spain, Sweden, Switzerland, Venezuela and Yugoslavia.

THE ALPHA-MOLYKOTE CORPORATION

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SPOT NEWS...

- **Machines to build a V-4 engine and four-speed transmission** for the forthcoming small Ford compact car (85-inch wheelbase) are to be delivered by August '61. Not all orders are placed yet, and there is still some question as to whether the power train will be manufactured in a European Ford plant or in the U S. Latest word is that Ford is having trouble finding suitable property overseas, so the job may wind up here. The August 1961 machine delivery date indicates late introduction of the new car as a '62 model.

- **One big machine not shown at the Machine Tool Exposition in Chicago** is a horizontal spline hobbing machine, said to be the largest in the world, which is installed at the builder's plant. It operates a hob with a 7-inch diameter and will cut shafts 144 inches long, with diameter up to 16 inches. Orders for four of the machines are reported on hand.

- **General Motors is developing impact extrusion from hot-rolled steel** to reduce machining work and go more directly from formed blanks to finished parts. Ball-end joints are being produced this way, and studies are now being made on differential side gears, starter gears, and even intake valves. Gear teeth will be cut as required on standard existing equipment. Process is cheaper and faster than cold extruding the blanks — then adding anneal and other extra operations.

- **Russians claim to have eliminated unproductive time** needed to carry work from one transfer machine to the next on a line. Machines are closely spaced in a circle, with each machine rotating around its own center axis. During machining, the machine rotates through a half circle, dropping the work into the hopper or magazine of the next. The first machine then returns at high speed to its starting position, is charged with new work, and a new cycle starts.

- **Remote monitoring and supervision of plants by centrally located** dispatching centers is getting a lot of attention from Russian and Red Chinese engineers, according to a team of six U S engineers just back from Russia.

- **Ford of Canada this fall will discontinue output of the Frontenac,** a version of the Falcon, and will replace it with an adaptation of the Comet.

- **Custom machining and finishing** of industrial and automotive engine components will be done by a new division of Hercules Motors Co, Canton, Ohio. The parent company will allot manufacturing space, machine tools and engineers to the Division, which will engineer and machine engine heads, transmission housings, and other major parts on a contract basis for outside firms.

- **Russians are now welding and soldering metals in a directed electron beam.** A trolley carries the work into a cylindrical vacuum chamber, where the work is exposed section by section to the electron beam. Welding temperature can be controlled up to 6000 C. Welding speed is 2 to 30 ft per hr.

- **Remington Rand will transfer manufacture** of standard and portable typewriters to Europe, probably Switzerland, by January 1. Some 3000 employees at Elmira, N Y, will lose their jobs in the move, with perhaps a few hundred absorbed by other Rem Rand local operations.

- **Argentina's first civilian mass-produced aircraft,** the Lockheed CL-402, will go on the market in early 1961. It's an all-aluminum, high-wing monoplane that carries six people and 1000 lb of cargo, is a joint venture of Lockheed and Industrias Kaiser Argentina. Estimated price: $22,000.

A Fast Cut To SAVE MONEY!

NEW MANHATTAN *Fast Cut* MOLDISC

DEPRESSED CENTER TYPE 27

- will remove more metal—
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Price each SPECIFICATION A24-Q8-BR	SIZE	25	50	100	250
	7 x ¼ x ⅞"	$3.46	$3.14	$2.77	$2.59
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Try The New MANHATTAN *FAST CUT* MOLDISC—
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ENGINEERED RUBBER PRODUCTS ... MORE USE PER DOLLAR

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WRITE TO ABRASIVE WHEEL DEPARTMENT
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RAYBESTOS-MANHATTAN, INC.

WASHINGTON...

Subcontracts for small firms...

Congressional small business advocates will be pushing next year for a plan to "put some teeth" into defense procurement policy dealing with subcontracting to smaller firms.

The scheme would give the Small Business Administration a more direct role in the policy. As its backers envisage the plan, SBA representatives would be stationed at major prime contractors' plants—as they now are at major military procurement offices—with access to the primes' production schedules and authority to direct subcontracting to small companies that are qualified.

A measure authorizing SBA such powers was introduced by Senator Proxmire (D, Wis) shortly before Congress adjourned last month. It passed the Senate, but was bottled up in the House.

Treasury's tax survey...

The Treasury Dept reports an "excellent response" to its new survey on US industry's depreciation practices. About 6000 replies to Treasury's questionnaire are expected, covering firms which account for almost two-thirds of corporate depreciation deductions.

Though it's too early for Treasury to make any conclusions on industry's view on the effect of faster depreciation on investment decisions and related questions, Under-Secretary Scribner says this: "The responses to date generally indicate a willingness to conform book depreciation with tax depreciation as a condition for liberalization. The majority also indicate they are willing to forego capital gain treatment as a condition for liberalized allowances.

Odds favor B-70 resumption...

Although the administration's recent decision to jack up Air Force spending for North American Aviation's B-70 development continues restrictions on the project's scope (limiting work to production of two stripped-down prototypes of the Mach 3 plane), the odds now favor reinstatement of the program to a weapon system status. This would mean resumption—on a limited scale—of important subcontracts for development of the aircraft's combat subsystems. Work on the bombing-navigation subsystem, automatic flight controls, defensive subsystem, etc. were terminated in last year's big B-70 cutback.

The Air Force is appealing the administration's policy and appears to be winning support for its view that resumption of subsystem work is essential. Among the companies to benefit: IBM, Sperry, Beech, and NAA's Autonetics Div. Limited funds, however, would put the reinstated subsystem development work at what one Air Force official describes as a "very austere" basis. So far, the administration is allowing the Air Force to spend only half the $200 million extra Congress appropriated for the B-70 program.

In all, the program's budget for the year amounts to slightly over $200 million, the Air Force recently said it would cost $365 million to put the program back into a full-scale weapon system status.

Fall capital spending drop?

Washington has confirmed what the machinery producers were feeling all along this summer: that American businesses were peeling back some of their plans for spending on new equipment this fall.

As the fourth quarter opened, industries all down the line had cut back their capital plant and equipment programs an overall $250 million from what they had indicated three months earlier.

The curtailment of plans meant that business in the last three months of the year will be spending at an annual rate of $37 billion—the same as was indicated for the current June-September period.

Durable goods manufacturers have reined in their programs more sharply than most other industries. Capital spending by hard goods producers hit a peak rate of $7.4 billion in the spring and then trailed off to a rate of $7.3 billion planned for both the current quarter and the final three months of the year.

Steel producers have budgeted spending at an annual rate of $1.6 billion in the final three months of the year—about what was laid out for earlier quarters. Automakers are programming their capital expenditures at an annual rate of $400 million for the rest of the year, slightly below their peak of $450 million set during the first three months of the year.

Running against the general trend are the machinery and equipment producers themselves. Their capital spending is forecast to continue to keep rising for the rest of the year, hitting a rate (seasonally adjusted) of $1.9 billion for the fall quarter. In actual dollar outlays, this amounts to $540 million.

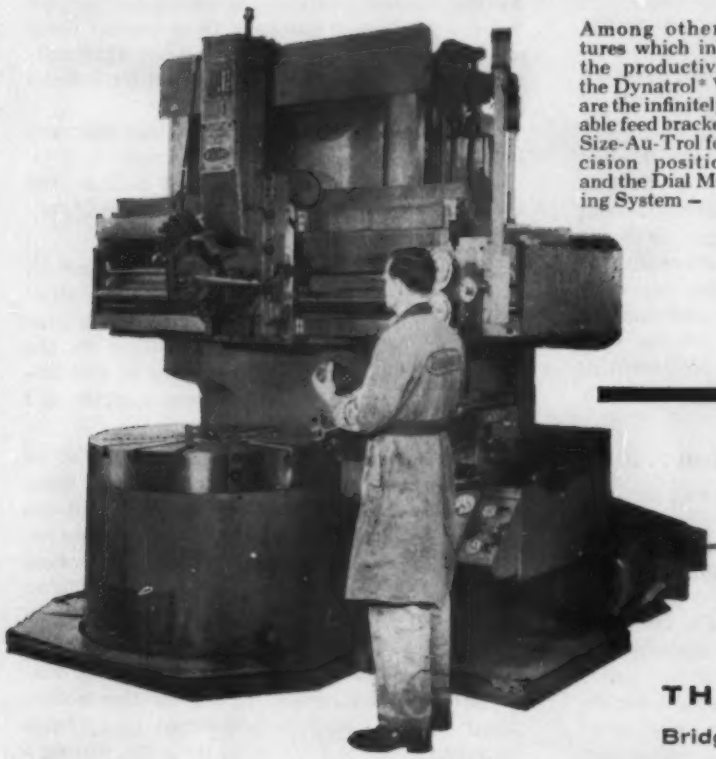
FINGER-TIP CONTROL

Increases Productivity of...

BULLARD

DYNATROL*
VERTICAL TURRET LATHES

Directional control of all head motions in feed on traverse, either horizontally, vertically or at any 45° angle, as well as table start and stop from a lightweight portable pendant, is a distinct production advantage.



Among other features which increase the productivity of the Dynatrol* V.T.L. are the infinitely variable feed bracket with Size-Au-Trol for precision positioning, and the Dial Measuring System –

It allows the operator to always be in the most advantageous position in relation to the work and eliminates the necessity of climbing for buttons or levers. By reducing operator fatigue and increasing his efficiency, more metal is removed per hour with a lower cost per piece.

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CIRCLE 224 READER SERVICE CARD

DETROIT...

Forward Look for '61...

Optimistic despite a summer of needling by dissident stockholders, Chrysler President Lester Lum (Tex) Colbert expects a 6.5-million car year in 1961 and hopes to increase his company's 15.8% market penetration. Much of the ammunition for this target, he believes, will be furnished by new compact Dodge Lancer.

The Lancer, on a 106.5-in. wheelbase, is nearly two feet shorter and about 800 pounds lighter than standard-size cars in the low-price field. It is powered by a 101-hp, 6-cylinder engine, which with an optional power package, can be boosted to 145 hp. For the time being, at least, this engine is of conventional cast iron construction.

The Lancer's unitized body is structurally identical to that of Plymouth's Valiant, but two-door sedans and hardtops have been added to both lines. Torsion bar front suspension is featured, and an alternator replaces the conventional generator. This unit produces alternating current, which is rectified to direct by miniaturized diodes. Main advantages are lighter weight and a constant supply of power, even at idle speeds.

Contrary to rumor, DeSoto is being continued in two body styles. Plymouth has been definned entirely, and there is little change in the Valiant. Chrysler is offering a new economy model (the Newport) that recently averaged 21.7 mpg on regular gasoline in a 510-mile test driven by a teenager chosen at random.

More predictions...

Chrysler's Colbert may prove pessimistic if General Motors executives are to be believed. Both Chevrolet's Edward N Cole and Oldsmobile's Jack F Wolfram look forward to a 7-million car year. Chevrolet, cocky in its seemingly permanent first sales place, expects to account for 2 million of this total. This is the one make that so far has not been hurt by its own compact.

Corvair accounts for about 20% of Chevrolet sales. And the record proves that this is plus business. Cole further expects that his new, slab-nosed "Corvair 95" commercial vehicles will sell at a rate of 45,000 units a year.

AMC'S heretofore accurate prophet, George Romney, flatly states that compacts, including imports, will take 50% or more of the 1961 market. He also notes that import sales are slipping rapidly, with a total of only 400,000 expected in 1961. This figure is off 260,000 from the peak of 1959 and has brought with it a significant mortality among dealerships in these makes.

Prices up?...

No automaker has yet set prices, but contrary to common speculation, steel will not be a factor in these decisions. Several key auto executives have noted off the record that a steel increase is not expected before spring, if then. However, Detroit as of September 1 started paying a 6¢ escalator wage hike to UAW-CIO members, as did many auto suppliers. Thinking now is that this will be reflected in a modest 1.3% price hike unless General Motors holds the line.

Making do...

Largely untold in the halo of record Rambler sales is how the company has managed to get **16 sales dollars for every dollar invested** in property, plant and equipment. The comparable figure for General Motors, Ford and Chrysler is about $4 each. In terms of net profit per dollar of property, plant and equipment in 1959 the company earned 87¢, versus 30¢ for GM and Ford and 1¢ for Chrysler.

The answer lies in a $43 million expansion program, which was spent almost entirely on better machinery and equipment, rather than bricks and mortar. This has enabled cars produced per employee to be pushed from 7.3 in 1956 to 17.7 in 1959. All plants are geared to 24-hour-a-day operation.

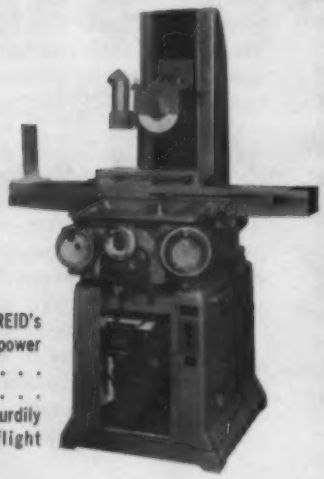
The addition of the third shift at the Milwaukee body plant not only required expenditures for equipment but also meant building of stairways, installation of elevators and the purchase of additional land for employee parking.

The third shift left no time interval between shifts to permit one group of workers to leave the plant before the new group arrives. The new procedure is for the incoming shift to take positions along the line, waiting for a bell that signals the shift change. The line never stops.

The ultimate fruit of Rambler's expansion program will be the capacity to build 600,000 cars a year. The cars themselves for 1961 have been extensively restyled, and one series features an entirely new die-cast aluminum engine. By 1961, the head for this engine will also be made of aluminum.

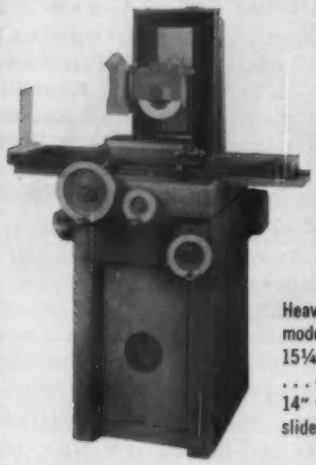
PRECISION SURFACE GRINDING DEMANDS A PRECISION MACHINE TOOL

That's why industry relies on REID the first name in Surface Grinders for nearly 60 years.



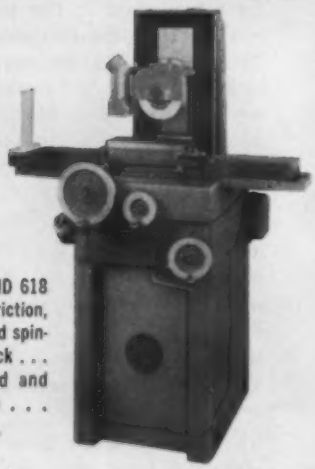
618 P

The "power" model in REID's popular 618 size with power table and cross-feed . . . automatic lubrication . . . convenient controls. Sturdily constructed for top-flight results.



612

Heaviest 612 hand operated model in the industry . . . 15¼" work height (7" wheel) . . . one shot lubrication . . . 14" table travel . . . 7" cross slide travel.



618 HA

The hand operated REID 618 . . . precision, anti-friction, belt-driven or motorized spindle . . . cross slide lock . . . complete underguard and dust guard protection . . . chrome plated screws.

618 PT

Another "work-horse" 618 . . . power table and hand operated cross feed . . . automatic lubrication . . . chrome plated screws (Shown with wet grinding attachment).

Before you buy, investigate the REID line . . . There should be a PRECISION REID in your future.

REID Surface Grinders can be furnished with such optional equipment as JIC, 110 Volt Controls, Chrome Ways and Motorized Spindle. Attachments for wet grinding, dust collection or cool grinding are also available.

PRECISION SURFACE REID GRINDERS

Manufacturers of precision surface grinders for production and toolroom needs

REID PRECISION SURFACE GRINDERS

REID BROTHERS COMPANY, INC. / 135B ELLIOTT ST. / BEVERLY, MASSACHUSETTS

AIRCRAFT and MISSILES...

TRENDS

Ebb tide on the West Coast . . .

Aircraft and missile industry employment in the crucial Los Angeles area is at the lowest point in nine years. The area workforce now stands at 150,000 — 15% below what it was just one year ago — and any forces that could stem the downward spiral are several months away.

LA's employment doldrums are particularly apparent in the "Help Wanted" columns, which are traditionally heavily weighted with recruiting inducements for the defense industries. Today, the volume of such ads is 25% less than it was at this time last year.

Inevitably, area employers have become more and more choosy as far as hiring of production workers goes. Even so, such personnel as mechanical engineers, electronics engineers, and technicians are hard to find.

Now that the industry's balance of production is tipped in favor of missiles, it is accepted as dogma that (1) the Defense Dept does not order missiles in quantity, and (2) fewer people are needed to make missiles than aircraft. Further adding to woes of West Coast workers are . . .

Automation troubles . . .

For a year now, the International Association of Machinists has been studying the effects of automation on employment. Adoption of a plan based on this study is being urged strongly by delegates to IAM's Convention in St. Louis this month. Under plan, the union would bargain for:

- An agreement with employers for advance notice of major changes involving automation.
- Extensive retraining of employees to handle other jobs.
- Transfer rights to new jobs.
- Early retirement in some cases.
- Equitable distribution of productivity gains.

Douglas and the engineers . . .

Douglas Aircraft, which is self-described as "still going through a difficult financial period," has nevertheless elected to restore (retroactive to April) all the salary cuts it has imposed recently on 210 members of the Southern California Professional Engineering Association. When the SCPEA men filed a grievance, an arbitrator ruled that the company restore the cuts.

President Donald W. Douglas, Jr, went the ruling one better—not only did he restore the cuts to the 210 affected engineers but to all salaried employees who had been affected.

Some encouraging signs . . .

Admittedly, the aircraft and missile business outlook isn't too bright generally, but here and there a silver lining has begun to peep through.

For instance, a loosening of Defense Dept money will permit the full funding of Lockheed's Samos reconaissance satellite.

The Navy has indicated that it will step up procurement of the Polaris missile.

Douglas has recently won a substantial contract for design and development of its Missileer aircraft as a launch platform for the Bendix Eagle air-to-air missile. The ten-year Eagle-Missileer development cycle will amount to about $3.4 billion. On top of that, Douglas recently snagged a $65 million NASA order for 10 Saturn stages.

Other LA primes also chalked up sizable orders: Northrop's Nortonics Division a big contract for Skybolt guidance systems, and North American a $168.5 million follow-on order for carrier-based Vigilante aircraft for the Navy.

Meanwhile, back at the Cape . . .

It now begins to look as though residents of Cape Canaveral can take the last of their furniture out of storage, and maybe start building that much-needed addition to the house. Reason is that NASA's recent announcement that it will make 260 shots over the next decade has given the community a sense of permanence.

The announcement has had a side effect—missile-men working for civilian contractors are now trying to affiliate themselves with NASA and the important space projects ahead.

But despite NASA's promise of a stepup in firings over the next decade, the tempo of shots has decreased materially this year.

For the record . . .

Even though the Russians have been grabbing headlines right and left by sending dogs, fleas, and whatnot whirling around space, the United States at last report had put about 9000 more pounds into space than Russia. Not only that, the U S has placed 23 pieces of hardware (satellites, probes and the like) into space, while the Russians have sent up only seven.

So far, the U S has shown far greater talent for miniaturization, the USSR for big boosters. Top prize in the race for space should go to the nation that first combines the two.

reduce costly manual labor with

CUSHMAN

AIR OPERATED CHUCKS

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

Manipulating a hand or foot air valve instantly opens and closes chuck jaws and eliminates tiring hand wrenching. In addition to reduced chucking time, Cushman Air Chucks do away with costly production slow-down and rejects due to operator fatigue and result in more profitable machining.

Completely safe, Cushman Air Operated Chucking Equipment is designed and built for rugged, continuous service and provides positive workpiece gripping with the advantage of being able to predetermine jaw pressure for the material being machined.

Other manufacturers have found that Cushman Air Chucks and Cylinders have effected outstanding production savings on both new and old equipment. Send for Bulletin No. PO-66D describing the many benefits and see for yourself.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

Manufacturers of Cushman Power Wrenches, Manually Operated Chucks and Face Plate Jaws

4CS60

MACHINE TOOLS...

Big buyers attend exposition . . .

Whether the Machine Tool Exposition at the Chicago Amphitheater set any attendance records or not, it attracted thousands of important buyers. Representatives of automobile makers were in the forefront, including key men from British, German and French firms.

Two groups of Japanese were conspicuous at the Show. A number of European machine tool builders came to Chicago to look over the new machines being put on the market by U S firms.

For a complete 16-page report on the significant new developments at the exposition, as well as at the Production Engineering Show and the Coliseum show, turn to page 109.

Talk of World Machine Tool Show...

The torrid temperatures that prevailed in Chicago at Exposition time already have led to demands from prominent builders that future expositions be scheduled at a cooler time of the year.

With availability of the new Exposition Hall in Chicago on the lake front beginning in November, talk already is heard about the possibility of a World Machine Tool Show in 1965 that would center around the Amphitheater but would also use all other Chicago facilities.

Pratt & Whitney to import . . .

Pratt & Whitney Inc, West Hartford, Conn, has arranged to import and distribute in the United States the smaller models of CWB-designed milling, boring and combined machines made by Mitsubishi Shipbuilding & Engineering Co Ltd, Tokyo, under license from Innocenti S G, Milan, Italy.

Pratt & Whitney also will distribute in this country the larger Innocenti boring mills made in Milan. The Mitsubishi machines to be sold by Pratt & Whitney were on display the past two weeks at the Second International (Coliseum) Machinery Show in Chicago. The display was in cooperation with Innocenti and Pratt & Whitney.

Mitsubishi is one of Japan's largest manufacturers, producing industrial machinery, chemical machinery and machine tools. Its shipyard has launched more tonnage the past four years than any other in the world.

Pratt & Whitney's latest action follows hard on its recent announcement that it is importing a French lathe designed and built to its standards. Pratt & Whitney also is to sell here some products of E M I Electronics Ltd, of Britain.

While Pratt & Whitney is importing machines, it has licensed a new company in England, Pratt Whitney & Herbert Ltd, to build its Keller machines and sell them in Great Britain. The new company was created with Alfred Herbert.

At the same time that the Pratt & Whitney-Mitsubishi-Innocenti arrangement was announced, P&W's president Jacob J Jaeger made public his firm's opposition to restrictions upon machine tool imports. He said that such action would invite retaliation by other countries where some U S builders are selling 50% of their production.

Best solution is installation of better machines, whether made here or abroad, that will enable manufacturers to reduce production costs, Mr Jaeger stressed.

The Pratt & Whitney-Mitsubishi-Innocenti sales arrangement continues the trend toward distribution of foreign machine tools in this country through the selling organizations of U S builders. Lapointe Machine Tool Co, Micromatic Hone, Clearing Machine and Michigan Tool are among the builders in this category.

When to use numerical control . . .

With major attention focused on numerical control at the just-closed Machine Tool Exposition, the question has risen: What are its potential applications? W D Geist, director of sales of Boeing Applied Computing Services, Wichita, Kan, spelled out an answer at the annual meeting of the American Machine Tool Distributors' Association.

He listed eight examples: (1) When there are a number of operations requiring several machining setups; (2) When machining operations are complex; (3) When machining time is low in relation to setup time; (4) When lead-time must be cut to a minimum; (5) When the part is complex, but must be made in short runs, or with variations; (6) When the part is so complex that human errors occur frequently; (7) When design, function or dimension of parts vary so much that an adequate inventory would be costly; (8) When other concerns in the same kind of business are able, through use of numerical control to quote better prices.

BF

You get extra production from Valenite extras!

...No Other Tool Holder Gives You All 9 Key Features

*Check This Comparison Chart**

See for yourself why more large manufacturers have chosen Valenite's Throwaway Insert Holders' as THE standard in their plants.

SPECIFICATION	MAKE OF TOOL																	
	VALENITE	A	B	K	D	E	F			G	H	I	J	K			L
							#1	#2	#3					#1	#2	#3	
Inserts of standard indexable design	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Adjustable chipbreaker	●	●							●	●	●	●	●	●	●		●
Surface to surface contact between chipbreaker and insert	●			●	●	●	●					●	●		●	●	
Replaceable chipbreaker—independent of clamp	●			●	●	●	●			●	●	●	●		●	●	
Removable locking pin prevents chip-breaker loss when indexing insert	●	●	●					●	●	●	●			●			●
Clamp arrangement does not obstruct chip flow	●	●	●	●	●		●		●	●	●	●	●	●			●
Clamp arrangement does not place an eccentric load on clamp screw	●	●		●	●	●		●	●				●	●	●	●	●
Replaceable and indexable shim seat—stocked for variable insert thicknesses	●	●	●	●	●	●				●	●	●					
Holders available in all styles for positive and negative rake, and square and triangular inserts	●		●		●	●						●					

*as developed by a large Eastern manufacturer

The new 32-page Valenite Turning Tool Manual lists over 200 styles and sizes of throwaway insert holders . . . gives job application data . . . has tracing templates for your engineering department. It's free. Ask for it on your company letterhead, or call your Valenite representative.

VALENITE METALS

BOX 205 C • ROYAL OAK, MICHIGAN

MATERIALS...

Methods from the military . . .

Electro-deposition of metal on phenolic resin, the use of various glass-epoxies, and dip brazing of aluminum are among the newer manufacturing techniques employed by the U S Army's Diamond Fuze Ordnance Laboratories.

Part of a program to develop a waveguide coiling machine, these methods are broadly applicable by industry. Casting waveguide components by the lost-wax method, a joint development by DFOL and Frankford Arsenal, has become an industry standard and marks a significant advance in precision casting.

Titanium in weapons . . .

Materials development has gone hand-in-hand with prototype weapons fabrication at Watertown Arsenal. Cannon are still preferred over rockets when it comes to continuous fire and close support, but the cannon must be lighter and more easily transported. Increasing demand for lighter weapons prompted accelerated development and application of higher strength materials. This in turn called for better cutting-tool materials. Titanium and uranium alloys are among the materials being used.

Heat-resistant coatings . . .

Coatings capable of protecting metals from oxidation at temperatures up to 1850 F have been developed by the National Bureau of Standards. Consisting of nickel-aluminum alloys, the coatings can be used to advantage on many types of aeronautical equipment and are likely to have a variety of commercial applications. Most durable of the coatings was one produced by electroplating nickel over the basis metal and then plating aluminum on the nickel from a fused salt (Cryolite) at 1300 F. The aluminum diffuses into the nickel.

Using the alloy as a coating (rather than as a basis metal), avoids the problem of brittleness found with Ni-Al cast alloys, especially when the basis metal is ductile.

On steel specimens (in air at 1025 F and 1850 F), the alloy coatings oxidized at one-tenth the rate of nickel coatings of comparable thickness. Steel panels coated with 0.002 inch of Ni plus 0.0005 inch of Al withstood 300 hours in salt spray before showing rust. Rapid thermal cycling between room temperature and 1025 F did not change this salt spray resistance.

For coating objects which cannot stand the high temperature of the cryolite bath, an alternate method for plating aluminum is used. It consists of depositing Al over the Ni at 330 F from a fuzed salt consisting of aluminum chloride and sodium chloride. Then the Al is alloyed by diffusion into the Ni by heating in air at 1000 to 1100 F for a few hours.

Japanese Carbide . . .

Sumitoms Skoji Kaisha, Ltd (Sumitoms Trading Co) of Osaka, Japan, displayed its line of "Igetalloy" tungsten carbide tools at the Production Engineering show. The company, which at last report was looking for a U S distributor, describes its specialties as single-point tools, blanks, milling cutters and other cutting tools. The company claims to have a productive capacity of seven metric tons a month. As far as is known, this is the first major effort of a Japanese carbide maker to enter the U S market.

Miniature pushbuttons . . .

Miniature industrial pushbuttons recently introduced by General Electric Co were used by more than 30 manufacturers exhibiting at the Machine Tool Exposition. Places as close as 1¼ inches apart, the buttons can save as much as 40% in panel space. Because all the units are oil-tight, they are suitable for use where cutting fluids and coolants are present.

Crush-ground rod rolls . . .

Multiple-groove crush grinding for rod mill rolls is made possible by a machine designed and built by Sheffield Corp, a subsidiary of Bendix Corp. Grooves produced by this technique are said to turn out steel rod that is more uniform and better finished than rods produced from turned rolls. Ground rolls can be harder than rolls which are to be turned. And they are reported to have groove life 250% longer than that of the hardest roll turned in a lathe.

Air in action . . .

Air controls were widely incorporated in heavy machinery shown at the Machine Tool Exposition, often in conjunction with hydraulic power. Pneumatic devices were apparent where high actuating speeds were necessary, as well as for clamping. A trend to air-bearing slides for ease of moving both heavy parts and heavy machine components appears definite. — *William M Stocker, Jr.*

MORSE...CINCINNATI BICKFORD GIVE A SHOW OF STRENGTH

Morse tough tools easily take the thrust of world's most powerful radial drill... utilizes its full power.

Cincinnati Bickford caused many a drill manufacturer to throw up his hands when they looked for a drill tough enough to stand up under the thrust of the most powerful radial drill ever built. They found what they wanted at Morse... a regular taper shank drill right off the shelf.

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WHAT'S AHEAD... in Metalworking

TRENDS

Summer doldrums linger on . . .

By now, it had been pretty well expected that the traditional summer slow season in metalworking would be over. Labor Day is usually regarded as the turning point when orders begin to step up, vacations are over, and industry settles down to eight months of solid work.

Not so this year. Segment after segment of metalworking reports little or no pickup in tempo of orders and production. One prime reason for this is that Chicago, Detroit, Cleveland, and New York-New Jersey area — in fact all, of the major East-Midwest metalworking centers — were tied up at press time by a major railroad strike.

Added to this: many metalworking industries were themselves going through, or preparing to go through, labor troubles of their own.

Especially affected by the Pennsylvania railroad strike is steelmaking. The slight upturn expected by this time (because customer inventories are down and need replenishing) has been cancelled out by the rail tie-up.

Steel industry officials now look to October as the month for a pickup. It's bound to come, they say, because customer inventories are getting far out of balance, and if Detroit makes good its promises of big orders, the tide should turn.

There is a feeling that consumer durables will call the upturn in the all-important fourth quarter. This feeling is especially prevalent among the more basic industries.

Take, for example, the currently pessimistic makers of fasteners, whose products are used in practically every metalworking industry. Without some brisk activity in the fourth quarter, they believe 1960 will wind up slightly below 1959. "We would be happy, in fact, to equal our 1959 results," one manufacturer says.

Screw machine products manufacture, a closely related industry, also reports that the anticipated post-Labor Day upturn hasn't materialized. But they are consoled by the fact that no further declines are expected.

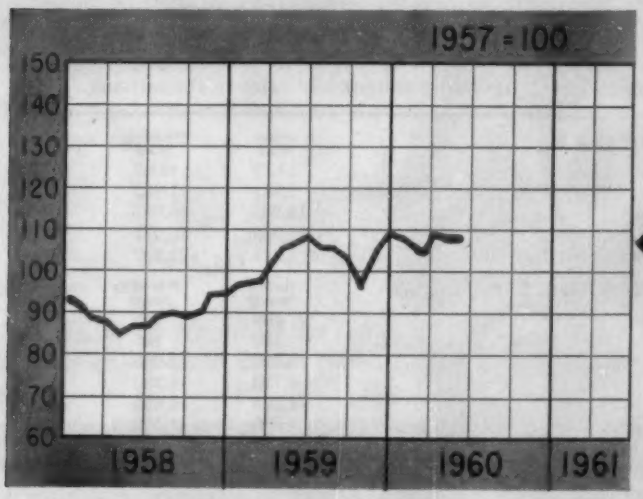
The screw machine people are hoping for a continued reduction of inventories at customer plants. Because customers bought heavily in the first quarter, then failed to hit anticipated production levels, the outlook for screw machine sales increases in the fourth quarter is slight.

Welders, too, are going through a slow business period, because customers are hesitant to make extensive repair outlays until business picks up.

At the moment, welding job shops report business is running behind 1959 levels, and it is likely that 1960 overall business will be down. But the welders do feel that they have reached the turning point, that they have "bottomed out," and there is no place to go but up.

Another industrial barometer, the bearings industry, contrary to the general trend, reports that the fourth quarter will show an improvement over current business levels — probably equalling fourth quarter 1959 totals.

However, the fourth quarter will not only have to make up for a bad first half but for a slow third quarter if the industry is to equal the business it did in 1959. Even a 25% expected fourth quarter business jump won't do the trick.



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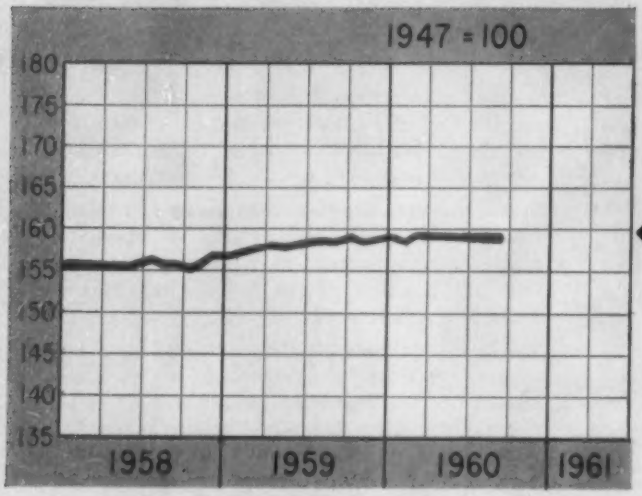
AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	AUG. Estimated	JULY Preliminary	JUNE Revised	JULY Year Ago
Total Index	**107**	**106**	**107**	**108**
Machinery	105	104	105	
Electrical Machinery	113	114	113	
Autos	111	120	114	
Other Transportation	87	83	96	
Other Metalworking	113	112	112	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	AUG. Estimated	JULY Preliminary	JUNE Revised	JULY Year Ago
Total Index	**159.5**	**159.4**	**159.4**	**159.3**
Metalworking Machinery	**192.2**	**192.2**		**185.6**
Other Machinery exc. Electrical	**172.5**	**172.5**		**171.1**
Electrical Machinery	**160.2**	**160.2**		**162.5**
Fabricated Metal Products	**147.6**	**147.7**		**148.6**

159.5

Capital spending and the business outlook...

A look at recent business news highlights some of the worries brewing over the business outlook for 1961. Take the latest Commerce Department report on capital spending. The result of a midsummer survey, the report shows that spending for new plant and equipment for 1960 will hit about $36.4 billion, thus falling short of the $37 billion forecast made earlier this year.

Significantly, the survey revealed that outlays will be leveling off in the final months of 1960, after a two year upswing. Spending now planned for the final quarter of the year is no greater than outlays being made in the current quarter. This means that capital spending won't be boosting the economy as a new year comes.

Ample capacity is one reason for the recent shaving of planned outlays. Manufacturers, for one group, simply aren't getting the business volume they anticipated early this year. At this point they are operating only about 83% of their producing capacity, though they've indicated that 94% of capacity is their preferred operating rate. Consequently, they don't feel a pressing need for added facilities, and have scaled down their spending plans.

In addition, the profits picture isn't as bright as had been hoped. Evidence now indicates that corporate profits will fall short of the $51 billion forecast for 1960. This, too, has dampened enthusiasm for making some capital outlays.

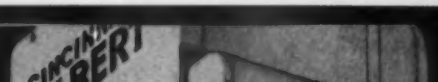
There are also signs that consumer spending may be losing some of the zip it's had over the past two years. The increase in installment credit volume during July, for example, was the smallest in some time. And this could mean that consumers are tightening up on purchases of durable goods.

Developments such as these cloud the business horizon as we head for 1961. Though business is good and still growing, prospects for another year of solid gains aren't as bright as they were a year ago. And homebuilding and government spending assume key roles in the outlook.

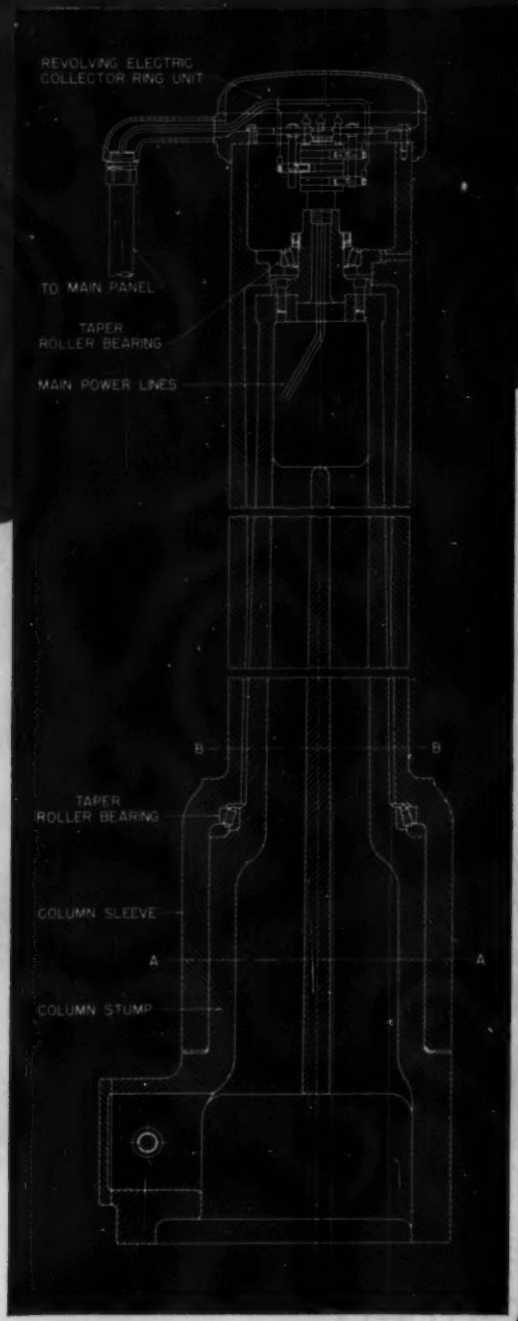
WEEKLY BUSINESS INDICATORS	*Latest Week*	*Preceding Week*	*Year Ago*
Business Week Index of Activity (1947-1949=100)*	145.9	145.7	149.8
Steel ingot operation (thousands of tons)	1,441	1,483	327
Electric power output (million Kilowatt hours)	14,941	14,602	13,759
Production of automobiles	51,553	38,952	17,261
Engineering construction awards (Eng. News-Record—thousands)	427,211	603,997	338,793

MONTHLY BUSINESS INDICATORS	*Latest Month*	*Preceding Month*	*Year Ago*
Index of industrial production (1957=100)*	109	109	108
Index of durable manufactures production (1957=100)*	105	105	105
Durable goods manufacturers' sales, millions*	14,850	15,060	15,771
Machinery manufacturers' sales, millions*	4,730	4,780	4,565
Durable goods manufacturers' new orders, millions	14,200	14,680	16,133
Machinery manufacturers' new orders, millions	4,610	4,750	4,922
New Orders for Nonelectrical Machinery (1950=100)*	179	176	182
New Contracts for Industrial Construction (1950=100)	151	154	141

* Seasonally adjusted



Rigidity Increased 50%



New thrust resistant, "TIMKEN" mounted column and sleeve assembly.

The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

Large Timken bearings at top and bottom when preloaded bind the column and sleeve into the equivalent of a solid unit for resisting functional stresses and cuts arm deflection to an absolute minimum. This definitely results in greater accuracy and longer cutting tool life. To further increase resistance to stresses the column sleeve departs from conventional design by employing a tapered inner wall providing an unusually heavy section where the greatest functional stresses are concentrated.

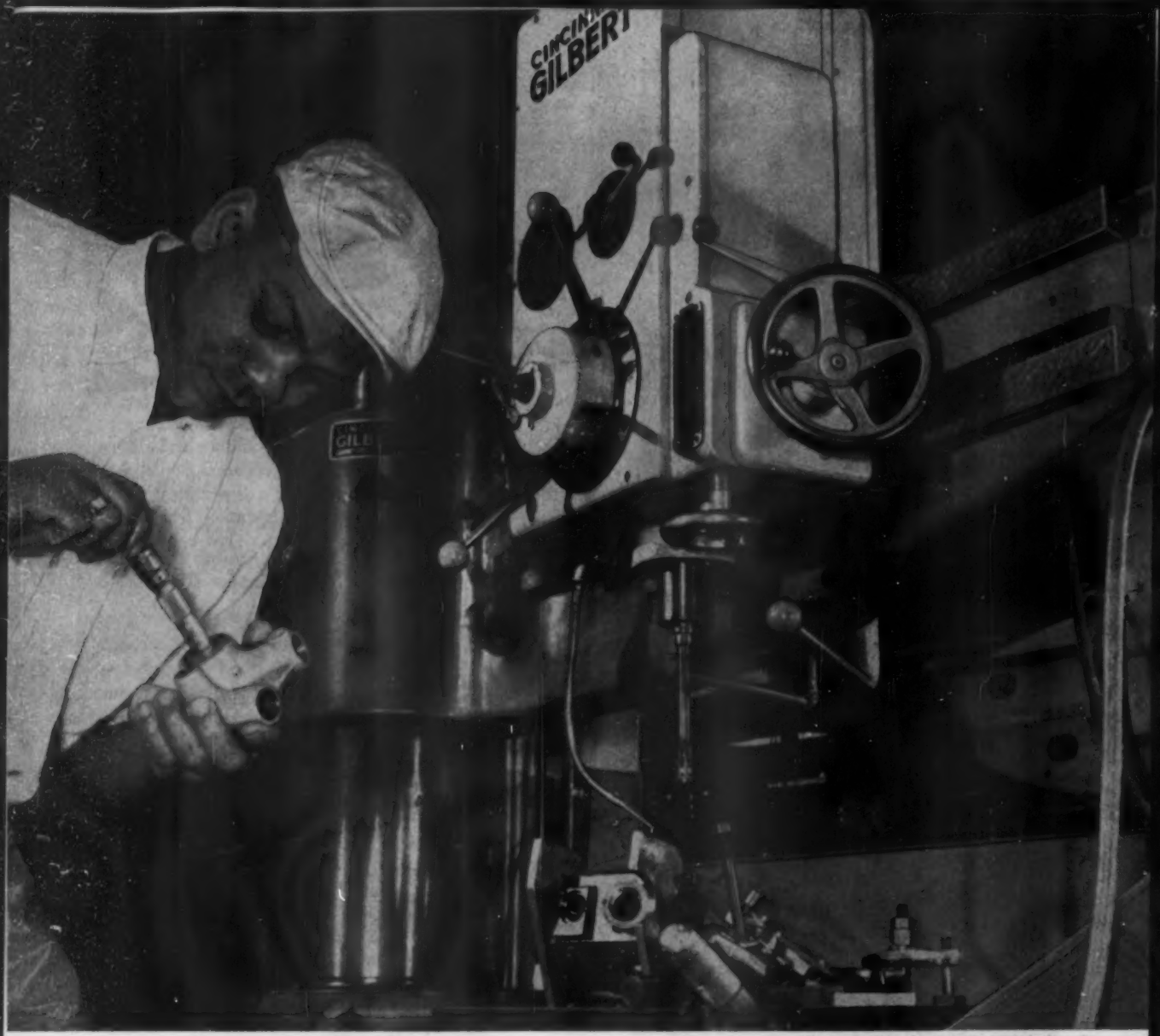
A new "NON-CREEP" clamping mechanism in combination with a solid column sleeve cuff adds greatly to the rigidity of this new "AMERICAN" Radial.

Write for Bulletin No. 328 for the complete story of More and Better Work at Lower Cost.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 229 READER SERVICE CARD



Courtesy North American Aviation, Inc.

North American Aviation gauges it right on a Gilbert

He's gauging a part for North American Aviation's F-100 modification program. Checking to see if it meets tolerances of plus .0005″ and minus .001″.

Not much doubt in his mind because he knows what his Cincinnati Gilbert radial can do when the tolerances get tight (and, as you know, they're getting tighter all the time).

Full spindle support near the tool contributes to accuracy. So does the balanced arm, which resists torsion, compression, and tension forces. And so do many other details which are described in our Bulletin 349.

Along with North American Aviation, you join a fine company of meticulous craftsmen when you acquire a Cincinnati Gilbert radial. Our representative will be happy to call at your earliest convenience.

The Cincinnati Gilbert Machine Tool Co., 3340 Beekman St., Cincinnati 23, Ohio.

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GILBERT

CIRCLE 230 READER SERVICE CARD

American Machinist | Metalworking Manufacturing ESTABLISHED 1877

Overriding Everything Else

The Kremlin Bosses have set out on a sweeping program of equipping Russia's metalworking plants with a total of 2,350,000 machine tools by 1965.

Even more significant, 65% of all machine tools then installed in the Soviet Union will be less than ten years old.

If this amazing plan . . .

can be successfully carried out, Russia will possess within five years the largest and youngest machine tool population in the world.

West Germany is moving in the same direction as Russia in striving to bring down the average age level of its production equipment. It won't be able to match Russia's accomplishment, but could come reasonably close.

Watching this sort of dynamism in action in Russia and West Germany, and seeing flashes of it in other parts of the world, one cannot help but wonder exactly what is holding things back here at home. While the rest of the industrial nations are expanding and modernizing their economies, we are doing precious little if any.

For three years, orders for production equipment have been disappointingly low. There is some encouragement, however, that things may be on the mend. A recent survey of AMERICAN MACHINIST/METALWORKING MANUFACTURING uncovered the intention of the nation's equipment users to speed up the placing of orders the next fifteen months.

Beyond that . . .

the Machine Tool Exposition which has just closed in Chicago should prod buyers into action. This show represented a technological breakthrough of major magnitude. The newly-designed machines displayed there obsolete most of the nation's installed machines. They are an answer to management's fervent wish for practical means of achieving cost reduction.

But even with any foreseeable pickup in replacement orders, our metalworking industry is fighting a losing battle against obsolescence. We are not replacing old machines fast enough to keep our machine tool population from getting older and less productive and more expensive to operate. The result is bound to be a drop in efficiency and a rise in costs.

This unfavorable situation is just cause for alarm. It augurs ill for our economy. It threatens our advantage against foreign competition.

What can be done to reverse the present trend and induce metalworking managements to replace their old machines? Arthur D. Little, Inc., is trying to find an answer to this question, at the behest of the Department of Commerce's BDSA by going direct to users.

This is all to the good . . .

but is not enough. Congress should bestir itself to enact legislation liberalizing depreciation allowances. The present depreciation system is, as the Monthly Letter of the National City Bank of New York charges, "An archaic tax structure seemingly and strangely dedicated to hampering our growth." It is in sharp contrast with Europe's "wise and realistic tax policies."

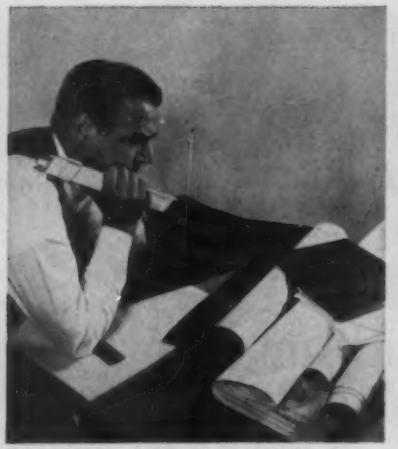
Overriding everything else, including government assistance, is the necessity for manufacturers to help themselves. Action by government or any other agency will not be fully effective unless management itself has the will, the courage and the foresight to modernize and move ahead—to the benefit of employes, the company stockholders and the national economy.

As proof, just look around you and see the success of companies that year in and year out hold persistently to a policy of keeping their production equipment up-to-date.

Burnham Finney EDITOR

NEW TOOL STEEL SERVICE

helps you estimate costs more accurately!



Estimating tooling costs, especially on new jobs,

becomes more accurate and profitable with Crucible's new Tool Steel Service.

This service enables you to use fewer grades of tool steels...

which you get to know inside-out! So, you can more accurately predict

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CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

Plastic nose cone is at tip of this Atlas ICBM, being fired at Cape Canaveral, Fla. Because this 125-in.-long nose cone (being lifted into position at right) is made of a "super plastic" ablating material, the missile will be able to re-enter the atmosphere without damage when it nears its target

"Super plastic" builds a better nose cone

Like a giant bullet flattened at the base, the nose cone (above) being hoisted into place on an Atlas ICBM is made of a new "super plastic" that is cheaper and easier to fabricate than old-style ablating materials for nose cones. And the new plastic, an organic substance, is of better quality than its predecessors.

Now operational on the Atlas, this Mark III nose cone is a product of General Electric's Missile & Space Vehicle Dept in Philadelphia, where new materials and new manufacturing techniques are constantly being developed and tested. From this work will come the commonplace materials of tomorrow, GE believes.

The constant research has paid off handsomely. L R McCreight (MSVD's manager of materials studies) points out, "We can produce the plastic for a fraction of the cost of protective coatings now being used." And Dr Leo Steg of GE's Space Sciences Lab reports that "Components and structures made with the new plastic can be produced quickly, compared to the weeks-long production schedule for current nose-cone protectors."

The new super-plastic is one of the so-called ablating materials, which dissipate the terrific heat built up during missile re-entry by burning and vaporizing into the atmosphere. Ablating materials differ from other types, such as heat-sink ones that store the heat without burning up.

MSVD currently is investigating both ablating and heat-sink materials in its vehicle re-entry work. In each type, usual practice is to cover a magnesium-casting frame with the material. Some missile builders, incidentally, think that a combination of ablating and heat-sink materials may eventually be the ideal.

Ablative materials include graphites, ceramics, and reinforced and unreinforced plastics. Heat-sink materials, on the other hand, are likely to be lead, copper, silver, or beryllium. For many heat-sink nose cones, like MSVD's Mark II, copper is selected because it is comparatively cheap and lightweight. The finished product usually has a nickel

Nose-cone protective material is shown here being tested at 15,000 F, some 4,000 F hotter than the surface of the sun. A carbon arc, encased in a water swirl, generates this terrific heat. Darkened glass protects the scientist-operator

plating over the copper, to prevent oxidation and to reduce heat.

Insulating materials are glass fibers and similar substances. These go beneath the exterior protective shielding and on top of the magnesium (or aluminum) frame. The whole missile gets painted to prevent oxidation and weathering.

Fabricating Mark III

One striking feature of the new Mark III nose cone—it's a casting. And, as Dr Steg puts it, "Relatively inexpensive and easy-to-procure equipment can be used to make it."

Normal practice is to fabricate plastic nose cones by either of two methods. In one, the protective material is molded in high-pressure presses. In the other, miles of special impregnated tape are wound around the nose cone, then machined to finish tolerances. Unfortunately, both tehniques are expensive. What's more, they cause many production delays and headaches.

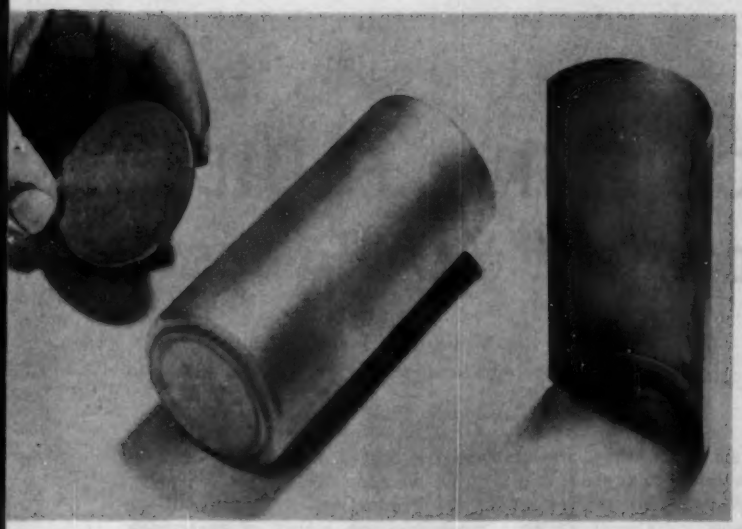
Making the Mark III is much simpler and faster. Although MSVD authorities are reluctant, for security reasons, to release detailed fabrication techniques, they do point out that their engineers continually try to use standard or semi-standard tools to fabricate and finish nose cones and affiliated components.

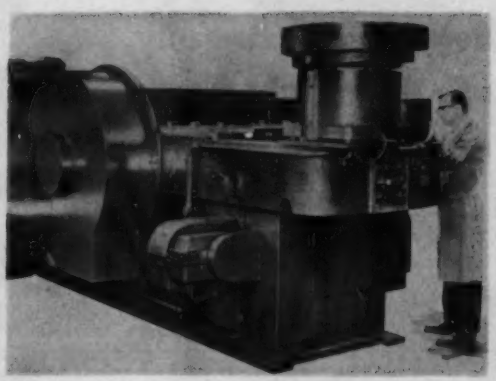
The bullet-shaped Mark III, 125 in. long, has a flared bottom that is 36 in. across. Although it is larger than the metallic Mark II cone, it doesn't weigh as much, chiefly because the 2500-lb. Mark II contains 1000 lb of copper. Shaped like a giant dish, the Mark II heat-sink cone has a 63.6-in. diameter and is 63.5 in. from the tip to base (photo).

MSVD is now working with such varied materials as aluminum, beryllium, magnesium, copper, reinforced phenolic-nylon resin, silicones, melamine, glass and other ceramics, graphite, Teflon, and laminated plastics. More than 5000 persons, in five major Philadelphia shops, carry out machining, fabrication, wiring, mockup, and assembly work. Some 4000 sub-contractors also supply specialized services.

In its re-entry shield work, MSVD has set up what it calls "a unique milling facility." It has also developed a special polishing machine that gives high finishes on large surfaces. And it has devised methods of fusing ceramic and metallic sprays to nose cones. From such work may come off-the-shelf, everyday products for home and industry in the not-too-distant future.

Polishing machine developed at MSVD puts an 8-to-12-rms finish on the copper heat shield of a Mark II nose cone. Inspector here checks finish on this heat-sink type of cone, which MSVD produces in addition to the Mark III ablating cone. Nickel-plate surface is about 0.040 in. thick, with thickness controlled to within ± 0.001 in. on all external surfaces, including edges and radii





Impact-extruded aluminum cans (left) are formed at rate of 120 per minute on 300-ton impact extrusion press. Wax impregnated blanks are fully annealed commercially pure aluminum, ⅛ in. thick by 2⅛ in. in diameter. Machine has turned out over 40,000 beer cans for a western brewer without tool failure

120 cans a minute . . .

Impact extruder forms seamless aluminum cans

One hundred and fifty years old this year, the metal can has just recently become news all over again. Behind this new leap into prominence is a metal just about as old as the metal can itself—aluminum.

Except for the fact that aluminum won't rust and that it weighs only one-third as much as steel, no one claims that aluminum is a better material for cans than tinplate. It's a question of cost. And the aluminum can is just now beginning to feel the benefit of better fabricating techniques aimed at high-volume, low-cost production.

The latest developments center on impact extrusion, regarded as potentially the lowest-cost method of aluminum can fabrication. (The other two methods are the conventional three-piece technique and deep drawing.) Impact-extruded can bodies are formed by subjecting an aluminum slug to very high die pressures that cause the metal to flow up around the punch.

Several machines have been designed to produce such can bodies. Latest is the National 300-ton Extrusion Maxipres (illustrated) which produces seamless aluminum can bodies at the rate of 120 per minute. This press, recently shipped to a western brewery, delivers the cans oriented for subsequent trimming, flanging, cleaning, coating, filling, and closing.

Developed by National Machinery Co, Tiffin, Ohio, the press accepts wax-impregnated blanks of fully annealed commercially pure aluminum (1100 S-1) from a vibratory feeder. These ⅛-in.-thick by 2½-in.-dia blanks are then backward extruded into 11-oz-capacity cans 2 7/16 in. in diameter with a wall thickness of 0.013 in. (plus 0.000, minus 0.001 in.). Bottom thickness is 0.025 in., plus or minus 0.005 in., and can be varied as the press runs.

In operation, blanks are fed into position at the die through an escapement equipped with a safety device that stops the machine quickly enough to prevent damage to the tools in case of a misfeed. The punch carries the blank into the die for backward extrusion and, upon retraction, is automatically stripped of the formed can. An automatic discharge conveyor, timed to the extrusion cycle, carries the can to the outside of the machine.

Rigidity is important

Of particular importance in obtaining high quality cans is the rigidity of the cast steel bedframe. National designed its frame to fully absorb the shock of impact extrusion. Also important in this regard is the accuracy of slide alignment. Instead of having the header slides running on bronze ways with clearance allowed for heat expansion and for passage of lubricant, this Maxipres uses preloaded roller bearings. The heavy slide requires no clearance at all, thus permitting extremely close wall-thickness tolerances.

Simplified setup

A forward and reverse jogging mechanism permits slow-speed inching for precise tool adjustment during setup. The automatic pressure-lubrication system, which is equipped with warning signals to indicate lack of lubricant or pump failure, meters the required amount of lubricant to each bearing.

42 billion metal cans in 1959

Of the 42 billion metal cans produced in the U S last year, about 200 million were aluminum, and the outlook is for rapid expansion in the use of aluminum. Biggest market at the moment is the frozen citrus concentrate field, but beer, tuna fish, and potted meats look promising.

Just recently, Alcoa and United Shoe Machinery Corp have introduced a quick-opening aluminum top. A single pull on an aluminum tab welded to the aluminum can end instantly removes the entire top.

Select them carefully, use them right and...

CUTTING FLUIDS can cut YOUR costs

By George W Vosmer, manager, Cimcool Division, Cincinnati Milling Machine Co, Cincinnati

Far too often, cutting fluids are chosen as a matter of personal opinion, or merely because one is cheaper than another. But personal bias and initial economy are poor yardsticks for evaluating performance over the long run.

The "sophistication" of modern machine tools, processes, and materials makes careful evaluation of cutting tool performance vitally important. Production costs can frequently increase or decrease radically, depending upon which cutting fluid is used. For this reason, a thorough analysis of cutting fluid performance should be made *before* one is finally chosen, and this can only be done through a cost study which takes into account all facets of the operation.

A complete analysis such as this is not done in a day. It requires some serious thought, may take weeks, even months. The results, however, will be well worth the effort in the long run.

To repeat, cutting fluids should not be selected on the basis of opinion or initial cost alone. Selection should only be made after systematic observation and evaluation of *all* items of a given operation affected by the cutting fluid. These include both tangible and intangible factors.

Tangible cost factors

The tangible (measurable) cost factors:

- Initial cost
- Mix cost
- Production rates
- Tool life and/or wheel life
- Overhead rates
- Part cleaning costs
- Machining cost per piece
- Cutting fluid life
- Scrap caused by rust
- Rework costs caused by rust

While several of these tangibles are not listed in the accompanying sample analysis chart, they are of critical importance. For example, rust or corrosion control is of vital concern in most metalworking operations.

No matter how a cutting fluid performs, if it does not prevent corrosion it does not do its job. Rust is costly—not only is there a loss on the corroded parts, subsequent assembly operations can also be delayed for lack of parts.

The expense involved in cleaning or degreasing of parts can also be costly. It is possible to save many dollars by eliminating expensive degreasing operations through use of a cutting fluid that does not leave the part with a coating which must be removed.

Intangible cost factors

The intangibles of cutting fluid evaluation unfortunately cannot be tagged with a dollar and cents value, but sometimes they are as important as the tangibles:

- Cleanliness of the shop
- Operator satisfaction
- Smoke problems
- Accuracy of work
- Ease of handling parts
- Adaptability to several jobs
- Safety (slippery floors, etc)
- Fire hazard

While it is not always possible to measure all items affecting overall production costs, it is possible to emphasize those factors which are measurable. In other words, while a few factors do not give an absolutely true performance picture, they do serve as guides—and a decision based upon a few facts is far better than an arbitrary choice based on nothing.

How to evaluate

In the accompanying sample evaluation chart are five major headings:

(1) **Cutting fluid costs**—here the actual cost of the fluid per gallon, and the cost of the mix in the machine are recorded.

(2) **Production**—this is one of the most common means of measuring cutting fluid efficiency. In the example shown, production increased from 600 pieces a week to 700 pieces through use of cutting fluid B, amounting to a saving of 10.9¢ per piece. Increases in feeds and speeds, and less downtime for tool changes are reflected in these figures. Such information can be helpful in short-run jobs, where a record of time per piece can be obtained.

(3) **Tool costs**, a very important item, can be obtained for even short runs by "tagging" the tools and keeping records.

(4) **Recharging costs.** Frequently these hidden costs are overlooked, but savings on this item alone sometimes pay for the cutting fluid. In the example shown, A would be recharged twice to once for fluid B. Thus the cost of A, even if it were free, would be twice the labor and burden costs of $10.50 to recharge the machine, or $21 total. The cost of fluid B over the same period would be $10.50 plus $5.88 for the mix, or $16.38—a saving of $2.54 even though fluid A were to cost nothing.

(5) **Yearly costs** are the total of all tangible costs listed on the chart and prorated for the year. The example shows that it does not take large savings on individual items to amount to a staggering sum per machine per year. The chart shows that with fluid A 30,000 pieces are produced in a year at a total cost of $26,536.25.

With fluid B, the cost for 35,000 pieces is $25,037.45, or $1498.80 savings. Add to this the cost of producing another 5000 parts (the amount required to equal fluid B's 35,000) with cutting fluid A. This amounts to 8.3 weeks more produc-

tion at $530.73 a week, for a total of $4405.06. In other words, the total savings with cutting fluid B is $5903.86.

In setting up a program for evaluating cutting fluids, there are several important points to bear in mind. Wherever possible, operations selected should be those in which operator variables do not influence the results.

For example, jobs should be selected that call for power feeds, and the operator should be cooperative and open-minded about running such a test.

"Trouble jobs," in which tooling, setup or machine conditions are known to be faulty, should be avoided.

If part finish is important enough to a job to be included in a chart on grinding performance, wheel grading must be correct, and spindle condition must be good.

COMPARATIVE CUTTING FLUID COST ANALYSIS

	Cutting Fluid A		Cutting Fluid B	
	A	Cost per piece	B	Cost per piece
CUTTING FLUID COSTS				
Cutting fluid costs per gallon	$.60		$1.96	
Dilution of cutting fluid	1:30		1:40	
Tank capacity	120 gal		120 gal	
Cost of cutting fluid to fill machine	$2.40		$5.88	
PRODUCTION				
Average number of pieces produced/8 hr day	120		140	
Average number of pieces produced/40 hour week	600		700	
Machine operator's rate	$2.50/hr		$2.50/hr	
Burden rate	$9.00/hr		$9.00/hr	
Production costs/40 hour week (Labor + burden rate x 40 hours)	$460.00		$460.00	
PRODUCTION COSTS PER PIECE (Production costs ÷ average number of pieces per 5-day week)		$0.766		$0.657
TOOL COSTS				
Average number of pieces produced for each grind of set of tools	40		81	
Average number of regrinds per set of tools/week	15		8.6	
Time required to grind a set of tools	90 min		90 min	
Burden rate for changing tools	$9.00/hr		$9.00/hr	
Length of time for changing tools	30 min		30 min	
Total time per week for tool changes	7.5 hours		4.3 hours	
Total cost of tool changes per week	$67.50		$38.70	
Tool changing cost per piece (Total tool cost ÷ average number of pieces produced per week)		$0.11		$0.55
RECHARGING COSTS (coolant life)				
Length of time in machine	4 weeks		8 weeks	
Cleaning time	1 hour		1 hour	
Labor or clean (hourly rate)	$1.50/hour		$1.50/hour	
Burden rate for machine	$9.00/hour		$9.00/hour	
Total cost of filling machine one time	$12.90		$16.38	
Recharging cost per week	$3.23		$2.04	
Recharging cost per piece (Recharging cost per week divided by average number of pieces produced per week)		$0.005		$0.003
YEARLY COSTS				
Total cost of tool changes per week x 50	$3375.00		$1935.00	
Total recharging costs per year (Number of cleanouts per year x cost of recharging)	$161.25		$102.45	
Total production costs per year (Production cost per 40-hr week x 50)	$23,000.00		$23,000.00	
Total yearly costs	$26,536.25 (30,000 parts)		$25,037.45 (35,000 parts)	
TOTAL COST PER PIECE PRODUCED		$0.881		$0.715
TOTAL COST OF PIECES PRODUCED PER WEEK	$530.73		$498.04	

TOTAL SAVING REALIZED WITH CUTTING FLUID B OVER CUTTING FLUID A PER YEAR: $5903.86

NEW AMTDA PRESIDENT
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Numerical control sparks new U S builder philosophy...

MORE MACHINE FOR YOUR

The machine tool industry is ready to provide industry with a whole new philosophy of production and productivity at an economically justifiable price. Numerical control is the core of that philosophy. It is a new concept in manufacturing, providing machine tool distributors with a whole new arsenal of selling ammunition.

"If we are not equipped to sell numerically controlled machine tools, we are not going to be in the machine tool business many years in the future."

Numerical controls sales training

J. R. Clark, president White Star Machinery & Supply Co Inc, Wichita, Kan, made these points in his presidential message to members at the 36th annual meeting of the American Machine Tool Distributors' Association at the La Salle Hotel, Chicago, September 3-4. He stressed that distributors' sales engineers must know all about numerically-controlled machines in order to sell them and therefore it will be the aim of the association to conduct numerical control sales training courses round the country, similar to those already held on the West Coast and in Wichita.

"We as machine tool salesmen must relearn that productivity is not just turning out more pieces per hour with no regard to cost, but . . . is really the means for producing greater economic value per consumer dollar." Modern machine tools are the key to greater productivity. It is time, in Mr Clark's opinion, that machine tool people themselves start selling bankers and investors, as well as shop men, that modern machine tools are a good investment which pays handsome dividends.

After three years of experience with numerical control, Boeing-Wichita is convinced that it can do even much more than it already has done and up to now it has increased machine run time each day, W D Geist, director of sales Boeing Applied Computing Services, told the convention. It has increased flexibility, allowing shipment of tapes between divisions or companies or agencies of government and enabling conversion from one job to another with relatively simple tooling changes. "The tape is not lazy, doesn't have a poor breakfast on certain days, doesn't suffer from a hangover."

N/C aids estimating

Numerical control has increased estimating accuracy, Mr Geist said. "We know exactly what our machine run time is going to be," with the result that jobs can be bid much closer. You can reduce your lead time over 75% and your tooling costs are lowered because you do not need control type tooling other than relatively simple holding fixtures and the ability to accomplish multiple operations while in one fixture. You can decrease manpower costs, since a numerically - controlled machine gives a productivity ratio of three to one, and in some instances up to 10 and 11 to 1. Both floor space requirements and materials handling are reduced.

Other benefits of numerical control, according to Mr Geist, are: improvement in quality, maintenance of constant manufacturing capacity, production of accurate duplication of engineering data. "These benefits allow us to remain competitive in a field in which costs are getting more scrutiny every day." But, he warned, "it takes real hard work and trial and error to learn to get the most out of these machines."

Foreign competition

With the existing tremendous disparity in wages between American and foreign producers, industry faces a competitive problem that challenges its ability to design the very best equipment, to create the most modern production methods, and, most important of all, to develop amongst the work force a knowledge and understanding so that the new equipment and methods are used to their maximum, Rudolph Bannow, president Bridgeport Machines Inc and president of the National Association of Manufacturers told members.

SECRETARY-TREASURER
William L Walker
President
Walker Machinery Co
Cincinnati

DOLLAR

Mr Bannow emphasized that the big job is to get the truth across to the people. It is so much nonsense to say that inflation is necessary to increase our economic growth; and too many people will do nothing to halt inflation. He warned that men sometimes are inclined to throw away carelessly the most valuable thing in the world—human freedom—and then battle for years on end to get it back. He advocated taking the brakes off the job maker, freeing the creative spirit, and "moving forward to an ever improving abundance with confidence in the future."

Missiles and tape

Impetus of ballistic missile development has encouraged the more rapid exploitation of tape programming, Lt Gen J H Hinrichs, Chief of Ordnance, Department of the Army, declared. "There is a great potential in the storage of tapes for emergency production of spare parts because this seems to be excellent insurance for uniformity where close tolerances are mandatory."

Ordnance receives 40 cents of the Army's dollar, Gen Hinrichs revealed. It spends 60% of the Army's research, development, test and evaluation money—and 70% of the money available for procurement and maintenance. Much the largest part of Ordnance funds goes out to industry and research institutions outside the government.

"The flashing progress of science," he said, "has cut the anticipated useful life of a new weapons system to about five years." It has become mandatory to telescope weapons programs and proceed concurrently with design and development, prototype fabrication, testing, production and even troop training." Any Ordnance program requiring more time (than the three years it took to get the Jupiter production going) "begs the question whether the investment is worth while in terms of the life expectancy of the end product."

Cold working guns

The new 105 mm M68 gun for the Army's new main battle tank is being produced by the cold working process, Gen Hinrichs stated. Watervliet arsenal is investigating the feasibility of applying the same process to the job of driving a mandrel through the gun tube bore by using much lower hydraulic pressures. Watervliet has increased elastic strength of gun tubes appreciably by use of the cold-working principle. Large-scale hydraulic pressure equipment, exerting hydrostatic pressure, is used. It produces a beneficial residual stress in the gun tube by an initial overstrain pressure that causes the tube to expand permanently. Tube weight has been reduced 30 to 60%, and savings in material and fabrication costs range from 10 to 40%.

Every machine tool company should tell its employees the basic facts about the industry and its own part in the industry, George T. Richardson, Machine Tool Division, Noland Co, Chattanooga, Tenn, told association members. "The more employes know and practice the good things about their company, the greater is the likelihood that they will pass on their faith and confidence to others.

Mr. Richardson urged each company to sell labor the true value of new modern machine tools, because "it is too late when labor leaders have made up their minds to oppose installation of a new cost-saving machine." He also recommended that each company do a public relations job in its own community—through newspaper, radio and TV publicity, talks before local societies, participation in local business and civic associations. "It's clear to me that until people understand machine tools, our sales are going to be 'hard sells' all the way," Mr. Richardson concluded.

Racine Hydraulics to cross-license with England's Vickers-Armstrong

A cross-licensing agreement whereby Racine Hydraulics & Machinery Inc, Racine, Wis, will sell and manufacture some of the high-pressure hydraulic equipment manufactured by Vickers Armstrong Ltd of England was entered into late last month. The reciprocal agreement reportedly will give Racine complete coverage of all industrial hydraulic applications.

Will make Vickers products here

The Racine company will also begin manufacturing some items of the Vickers line sometime next year, and is expected to manufacture the entire line within three years.

Vickers-Armstrong, on the other hand, will manufacture Racine hydraulic equipment at its Weymouth, England, plant, and will distribute it throughout the British Commonwealth and European countries through Racine's Swiss subsidiary.

Addition of Vickers equipment to Racine's line is expected to open up major new markets for the U S firm in such products as press brakes, lumber and paper mills, and large machine tools.

This is the third tieup with a U S firm for Vickers. Previously, it has entered into agreements with Clearing Division of United States Industries, and more recently with McKay Machine Co of Youngstown, Ohio.

Acquires Sarasota Firm

Simultaneously with its announcement of affiliation with Vickers, Racine released the news that it has acquired Sarasota Precision Products Inc of Sarasota, Fla, a manufacturer of small aluminum hydraulic valves. Acquisition of the Sarasota line of miniaturized valves opens up diversification into several new markets for the parent company—especially in the fields of roadbuilding, construction and farm machinery.

Racine Hydraulics, in line with its expansion and diversification programs, is about to complete new research and development facilities, and to add some 40,000 sq ft of manufacturing space at a total cost of more than $500,000.

industrial diamonds...

MAN-MADE

"Man-made diamonds show marked superiority over natural diamonds"

By N H Leventhal
Diamond application engineer
Metallurgical Products Dept
General Electric Co
Detroit

Man-made diamonds, manufactured under controlled conditions, show marked superiority over natural diamonds in laboratory surface-grinding evaluations.

Some companies are so determined to find out which type of diamond wheel gives best results at lowest cost that they make continuous studies of performance. This is all very well for big plants that can afford it, but smaller companies find that results are simply not worth the cost of record-keeping and the time involved, mainly because the great variety of shapes to be ground makes it almost impossible to compute volume of stock vs wheel wear.

Reason for the tests

Recent General Electric tests along this line have had a two-fold purpose: (1) to provide cost-performance yardstick for users who cannot compare wheel lives accurately, and (2) to provide comparative information for users who are able to measure wheel wear against volume of stock removed.

GE tests were made in a laboratory, but they closely parallel shop conditions. One grade of carbide was ground at a time on a Norton S-3 6x18-in. hydraulic surface grinder with automatic table speed and crossfeed. The test wheels were 5x3/16-in. resinoid D1A1 (straight) with 100 grit, 100 concentration. Grinding conditions were 0.050 in. crossfeed/pass, 50-fpm table speed, 5500-sfpm wheel speed, and downfeed varying from 0.001 to 0.003 in./pass.

The test blocks were 4x6 in. made of carbide inserts cemented to a steel block with resin. Both types of diamond wheels (natural and man-made) were made at the same time with the same batch of resin cured side by side.

Three grades of Carboloy cemented tungsten carbide were ground in the tests; 883—for cutting cast iron and nonferrous materials, 44A—for roughing nonferrous materials, and 370—for heavy-duty roughing cuts on ferrous materials (except CI).

Table 1 shows three main results: (1) effect of the different grades of carbide on diamond-wheel life, (2) effect of increasing the downfeed on wheel life, and (3) a comparison of man-made and natural diamond wheels in all tests.

One particular trend is the effect that feed/pass has on the obvious superiority of man-made diamonds. As wheel feed increases, the advantage of man-made diamonds is reduced from almost 4:1 down to about 1½:1. The higher downfeed is considered poor grinding practice, but these conditions were included to see if high downfeed could be a cause for failure—but the test results show that even at abnormally high feed rates, the man-made material is superior.

Table 2 shows similar data, but on the basis of diametrical wheel wear, which also indicates the advantage of man-made diamonds.

If a grinding wheel wears less as it makes a pass across the work, with a specific depth of cut, it will remove more stock. This is illustrated in Table 3, where wheel wear has been taken into account to show greater stock removal by man-made diamonds. In all cases the surface finish was the same.

On the basis of time (Table 3A)

(Continued on page 104)

TABLE I: Comparison of grinding ratios

(Cu in. carbide removed/cu in. of wheel wear on three grades of carbide at 0.001, 0.002, 0.003-in. downfeed per pass)

Carboloy grade	883			44A			370		
Downfeed/pass	0.001	0.002	0.003	0.001	0.002	0.003	0.001	0.002	0.003
Natural diamond	39	17	13	32	14	8	22	12	9
G-E Type RVG	144	30	18	103	20	13	76	18	13
% Superiority GE over natural	270%	77%	38%	222%	43%	63%	245%	50%	44%

TABLE II: Comparison of wheel wear per cubic inch of carbide removed

Carboloy grade	883			44A			370		
Downfeed/pass	0.001	0.002	0.003	0.001	0.002	0.003	0.001	0.002	0.003
Natural diamond	0.0174	0.0405	0.0530	0.0210	0.0492	0.0857	0.0306	0.0595	0.0840
G-E Type RVG	0.0047	0.0227	0.0390	0.0065	0.0334	0.0517	0.0088	0.0370	0.0527

or NATURAL?

"Conventional natural diamond grit has never been successfully challenged"

In the field of diamond abrasives, conventional natural diamond grit has never been successfully challenged as the most effective material for broad-range usage.

And natural diamond grits are more efficient today than ever before, as a result of research correlating the effects of particle shape with abrasive action. This, in combination with advances in crushing and sorting on a production basis, now makes it possible to tailor natural diamond grit to a particular grinding job. The result: efficiency bonuses in wheels, saws, hones, and other abrasive tools.

New developments

It is impossible to say this or that type of grit is X percent better than another, without stating the specific job conditions involved. It is thus desirable to clear the air by analyzing just what the new developments in natural diamonds mean in the way of increased grinding efficiency and longer abrasive tool life.

Conventional natural diamond grit not only is highly efficient in resin, vitreous and metal-bond wheels, it can be used in applications ranging from heavy plunge grinding down to finish grinding, honing and lapping.

For example, natural diamond is the optimum abrasive for resin-bonded wheels at heavy plunge feeds (0.003 in. and heavier) in carbide hogging applications. Plunge grinders, who take off as much as ⅛ inch or carbide at a single pass, find this to be the least costly method. Admittedly, wheel consumption is greater but the cost is more than offset by savings in labor, overhead, and time.

Continuing research

Yet high as is the present efficiency of natural diamond grit, even higher efficiency is being sought by continuous research carried out at Engelhard Hanovia's Diamond Technology Laboratory in Newark, N.J.

Investigations there and at other diamond rearch centers have led to a more complete understanding of the effects of particle shape on abrasive action.

Two new specialty grits

Certain particle shapes are now selected from natural diamond grit, resulting in the introduction of two new types of specialty grits: SND-RB (needle) grit, available treated and untreated, and SND-MB (blocky), available in standard and premium grades.

In line with the new developments in particle shape, a new term has been introduced into the volcabulary of the diamond industry—"shape count."

How a shape count is made

The shape count of a grit is in essence a description of its average diamond particle shape. Basically, there are four shapes: (1) cubes, which are extremely rare; (2) blocks, which generally have a similar ratio between all three spatial dimensions; (3) rectangles or particles shortened or lengthened in one dimension, and (4) needles, flats, plates or slivers.

The shape count of a grit, as has average shape of individual particles constituting the grit. For instance, if a grit contains 25% blocks, 40% rectangles, and 35% needles and flats, the weighted average would give the grit a shape count of 3.10, arrived at this way:

.00 x 1 (cubes)	=	.00
.25 x 2 (blocks)	=	.50
.40 x 3 (rectangles)	=	1.20
.35 x 4 (needles, flats)	=	1.40
1.00		3.10

This shape count is determined by taking a statistical sample of 100 particles from a grit, examining them under a stereoscopic microscope, and actually counting the number of particles of each shape.

By John H Olson, head
Technical Service Dept
Industrial Diamond Division
Engelhard Hanovia, Inc
Newark, N J

It is also possible to separate the different particle types in crushed diamond powder mechanically. The accuracy of this method, known as SND (Selected Natural Diamond), is relatively high. To the term SND are added the descriptive suffixes RB (resin bond) and MB (metal bond). "Needle" and "Blocky" indicate the diamond particle shape. Thus premium blocky grit can be designated, for example, as SND-MB (Blocky) 2.8. (The latter figure is the shape count.)

The shape count of a grit profoundly affects its abrasive action. Fortunately, both high and low shape counts have significant advantages in varying conditions of wheel bond, work material, and grinding method.

Why shape is important

And because shape numbers do not measure precise physical relationship but are merely arbitrary designations, a very small change in numerical value represents a considerable variation in properties of the grit.

A good example of a high shape count material is SND-RB (Needle) which is natural diamond grit with a shape count exceeding 3.1. It was

(Continued on page 105)

the man-made diamond also shows advantages. Though a downfeed of 0.003 in./pass removes a cubic inch of carbide in half the time required at 0.001 in./pass, the increase in wheel wear makes this much speed-up too expensive.

Types of diamonds

Both natural and man-made diamonds are now available in improved versions that were not available a short time ago. The current GE type RVG for resinoid and vitrified wheels has improved friability over the original made-made material. Treated and untreated SND materials are also more friable than untreated natural diamonds, and are comprised of slivers and flakes that approach the man-made material. Recent field tests show that type RVG is superior to natural diamonds for grinding carbide-steel combinations; the earlier GE material was not as good as natural diamond in this application.

"Special" for metal bonds

In addition, GE is now marketing a diamond grown specifically for metal-bonded wheels that require 80 grit and finer—this is designated type MBG. The advantage of the GE diamond process is that crystal growing conditions can be controlled to produce diamond shapes and sizes as desired for specific applications, rather than crushed and shaped to approximate requirements. In time there will no doubt be more types and grades available for more specific jobs.

Table 4 shows a comparison of the natural diamond, treated SND grade, and GE type RVG on the basis of grinding ratio (cu. in. removed/cu in. of wheel wear), specific wheel wear, and carbide removal rate. The data for untreated natural and SND diamonds here compares closely with data from a report by Dr R G Weavind, director of research at the Diamond Research Laboratory (DeBeers), entitled "Factors Affecting the Efficiency of Resin Bonded Diamond Grinding Wheels." This report showed grinding ratios of 27 (100%) for standard natural diamonds, and 39 (144%) for SND natural, which checks closely with our data. The figures are for straight wheels on peripheral grinding; it is not known how the two types of natural grit

TABLE III: Comparison of carbide removal rates*

(Percentage carbide removed per unit time)

Carboloy grade	883			44A			370		
Downfeed/pass	0.001	0.002	0.003	0.001	0.002	0.003	0.001	0.002	0.003
Natural diamond	100%	100%	100%	100%	100%	100%	100%	100%	100%
G-E Type RVG	116%	117%	120%	118%	116%	119%	123%	116%	125%

*Carbide areas for Grade 883: 26.6 sq in., for Grade 44A: 22.5 sq in., for Grade 370: 21.7 sq in. Time needed for one complete crossfeed on test block: 2 minutes.

TABLE IIIA: Comparison of time (minutes) required to remove 1 cu in. of carbide*

Carboloy grade	883			44A			370		
Downfeed/pass	0.001	0.002	0.003	0.001	0.002	0.003	0.001	0.002	0.003
Natural diamond	94	58	46	116	70	59	123	74	62
G-E Type RVG	81	49	38	98	60	50	100	64	49

*Carbide areas for Grade 883: 26.6 sq in., for Grade 44A: 22.5 sq in., for Grade 370: 21.7 sq in. Time needed for one complete crossfeed on test block: 2 minutes.

TABLE IV: Comparison of G-E Type RVG, normal natural and natural SND treated

	Grade 370 Carboloy—0.001-in. downfeed		
	Grinding ratio	Wheel wear per cu in. of carbide removed	Carbide removal rate
Natural (100 grit)	22—100%	0.0306-in.—100%	100%
Natural SND treated (coarse)	37—168%	0.0185-in.—100%	109%
G-E Type RVG (100 grit)	76—345%	0.0088-in.— 28%	116%

TABLE V: Comparison of G-E Type RVG diamond and natural diamond girnidng Carboloy Grade 370

(Interrupted and uninterrupted cut—0.001-in. downfeed)

	Grinding ratio	Wheel wear per cu in. of carbide removed	Carbide removal rate
UNINTERRUPTED CUT			
Natural	22—100%	0.0306-in.—100%	100%
G-E Type RVG	76—345%	0.0088-in.— 28%	116%
INTERRUPTED CUT			
Natural	23—100%	0.0276-in.—100%	100%
G-E Type RVG	81—350%	0.0084-in.— 30%	122%

compare in cup wheels.

Most production grinding occurs on small tool elements, not on large areas of carbide, so we made up a test to compare interrupted and uninterrupted cuts on carbide. One sample part was a solid block of carbide; the other a group of ½-in. inserts of the same total area but mounted with separations between them. Table 5 shows a comparison between natural and GE diamonds on these two samples. The results indicate clearly that there isn't much difference between the two kinds of cuts, and that wheel wear depends on the amount of carbide ground rather than test-block configuration.

The conclusions drawn from these tests is that two factors are responsible for the superiority of the man-made diamond material, friability and particle shape. The rough, irregular shapes of the man-made materials improve friability and aid the bond in holding the diamond in place.

NATURAL DIAMONDS (continued)

introduced to the market as "SND-Needle" on a fully commercial basis in April of this year. Before that time, the material underwent extensive laboratory tests and field evaluation in many of the nation's metalworking plants.

SNB-RB (Needle) grit has been found to be most effective in resin-bonded, flare-cup grinding wheels used at intermediate infeeds in the dry grinding of cemented carbide tools. An advertising claim of "30% more efficient than conventional natural diamond grit under the proper conditions" is, if anything, conservative, because later grinding reports show the efficiency has more than doubled.

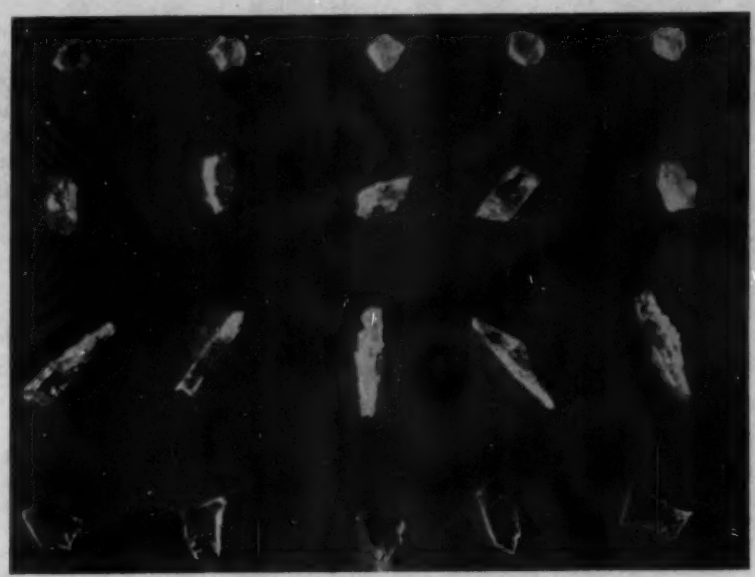
"Frailability"

This phenomenon of greater efficiency and extended wheel life achieved by selected natural grit is explained by three facts: (1) High-shape-numbered particles present a greater surface area to the resin bond and are thus held more firmly, (2) as the thinner particles are dulled in use, they tend to fracture a bit at a time—constantly forming new, sharp cutting edges, and (3) this greater "frailability" holds down pressure which might tear the particle from the bond.

The case for needles

For these reasons, SND-RB (Needle) particles tend to stay on the job longer, and they resharpen themselves, thus providing the effect of many more cutting edges per carat of diamond. When cemented carbides are ground with Untreated SND-RB (Needle) grit in resin-bonded wheels at infeeds from 0.0005 to 0.0015 in. and higher, the user benefits greatly.

Recently, efforts to improve the efficiency of SND-RB (Needle) grit have resulted in a special surface treatment that increases the friability and bondability of the particles. This grit is called "SND-RB (Needle) Treated, and was made available commercially at the same time as SND-RB (Needle) Untreated. It is most effective in resin-bonded wheels used in grinding carbides at infeeds under 0.001 in.



Typical natural diamond particle shapes: Top row—"blocks," assigned a shape number of 2; second row—"rectangles," shape number 3; third row—"needles," shape number 4; bottom row—"flats" or "plates," also assigned shape number 4. Not shown—extremely rare "cubes," shape number 1

What about the other end of the particle scale—SND-MB (Blocky)? In point of time, this is a newer grit type, made available in experimental quantities under the name "SND-Blocky" only during April of this year.

This material consists of stronger particles, selected for their lower shape number, and has undergone a process which removes the more-friable, high-shape-number particles. It is available in two grades: Premium Blocky Grit, which ranges in shape count from a low of 2.1 at the 16/20 mesh size to a high of 2.8 at the 270/325 mesh size; and Standard Blocky Grit, with corresponding shape count figures of 2.4 to 2.9.

At the time of this writing, SND-MB (Blocky) is still produced only on an experimental basis for field evaluations, but indicatons are that this more-rubbed natural diamond materials is unsurpassed for use in metal-bonded wheels, where the harder bond material erodes at a significantly lower rate. Principal applications of this new grit type: grinding of ceramics, glass, concrete, stone, etc.

The summing up

To sum up the case for natural dimonds in industry: In addition to conventional natural grits with their broad range of properties, new specillay selected and processed natural diamond grits offer important advances in grinding efficiency. It is of vital importance to the user of abrasive materials and tools that he acquaint himself with the advantages that each type of natural diamond offers for specific applications.

WHAT IS THE MOST IMPORTANT FACTOR IN YOUR COMPANY'S DECISION TO INVEST ABROAD?

Percent of Companies Answering*

INDUSTRY	Higher profits	Competition	Lower labor costs	Availability of raw materials	Trade restrictions	New markets	Other
Primary Metals	27%	0	0	55%	0	18%	0
Machinery	3	16	16	0	13	64	0
Electrical Machinery	34	8	0	0	25	25	8
Transport Equipment, Including Autos	13	7	0	0	20	73	0
Other Metalworking	33	17	0	0	17	50	0
Chemicals	14	9	9	14	38	43	0
Paper	25	12	0	25	0	25	13
Rubber	50	0	0	0	0	75	0
Stone, Clay & Glass	25	50	0	25	0	50	0
Food & Beverages	14	7	0	0	7	71	7
Misc. Manufacturing Including Textiles	25	8	17	8	33	50	0
Petroleum	45	0	0	64	0	9	18
ALL MANUFACTURING	20	10	6	13	16	48	3

*Adds up to more than 100 because some companies indicated more than one alternative

CANADA

INDUSTRY	Actual 1959	Planned 1960	Planned 1961
PRIMARY METALS	$ 6.3	$ 15.5	$ 4.4
Machinery, including electrical	34.9	38.6	37.6
Transport equipment, including autos	32.3	23.3	24.8
Other metalworking	14.3	9.0	10.1
ALL METALWORKING	81.5	70.9	71.9
OTHER MANUFACTURING	132.4	157.3	156.4
ALL MANUFACTURING	220.2	243.7	232.7

US metalworking invests heavily

Foreign capital expenditures by the U S metalworking industry will hit $635 million this year and will soar to over $755 million in 1961. Manufacturing companies, taken as a whole, will probably set a new record this year and next with planned expenditures well over $1 billion. This is considerably above the 1957 figure of $929 million, which is believed to have been the previous peak year for manufacturers' overseas spending.

According to this latest McGraw-Hill Department of Economics survey of the foreign operations of U S industrial companies, the total foreign investment for plants, equipment, and property will reach 2.4 billion. This includes the figures shown above plus the expenditures of the petroleum industry. The companies reporting in the survey account for about three-fourths of all capital expenditures overseas by U S manufacturers and petroleum companies. In general these are the larger companies in their industries, but it is these larger companies that make almost all capital expenditures abroad.

Machinery builders lead the way

Within the manufacturing industries the machinery companies (including electrical) plan to spend the largest amount, $351.1 million. They also plan the largest percent increase, 41% more than last year. And they already are planning to increase expenditures to $410.8 million in 1961.

The transportation equipment industry (including autos) will spend $258.5 million in 1960, an increase of 20% from last year, and plans to invest $310.2 million overseas in 1961. The only segment of metalworking that reports a decrese in overseas expenditures this year are the fabricated metals and instrument industries. Primary metals is expected to show a drop of some 22%, from $104.5 million in 1959 to $81.5 million in 1960.

If manufacturers carry out their present plans, their overseas investment in 1961 will, for the first time, exceed that of the petroleum companies. Petroleum companies reporting in the survey plan to spend $1.3 billion this year for overseas facilities and $1.2 billion in 1961.

A shift to the Common Market

Most striking development in the regional pattern of investment is the shift to the Common Market countries. Manufacturing companies indicate that 17% of their overseas expenditure in 1959 were in Common Market countries. They now plan to increase this proportion to 24% in 1960 and to 27% in 1961.

The machinery industry (including electrical) and the transportation equipment industry are concentrating heavily on their European operations. Companies in both groups indicate that they plan to spend about one-third of their total overseas investment in Common Market countries this year and next.

Money goes for new plants

Almost all the foreign capital expenditures of American companies go for purchase of new plants and equipment. Manufacturing companies report that only 7% ($70 million) of their 1959 investment abroad was for the purchase of land and existing facilities, and that about one-third of this went into Common Market countries. In 1960, $131 million (about 12% of the total capital outlay) will go for existing facilities and land; in 1961, $105 million (about 8%). About one-third of the 1960 land and existing facility expenditures will be made in Common Market countries; almost one-half in 1961.

Why they go abroad

Just about half the companies reporting to this survey state that new markets are the most important factor in their company's decision to invest in plant and equipment overseas. Anticipating the growing demands of the European countries, particularly the Common Market countries, American manufacturing firms are concentrating their expenditures in new production facilities in this area.

Second most important reason for investing abroad is higher profits.

U S OVERSEAS CAPITAL EXPENDITURES BY REGIONS
(Millions of Dollars)

LATIN AMERICA			COMMON MARKET COUNTRIES			REST OF EUROPE			OTHER			TOTAL			
Actual 1959	Planned 1960	Planned 1961	Actual 1959	Planned 1960	Planned 1961	Actual 1959	Planned 1960	Planned 1961	Actual 1959	Planned 1960	Planned 1961	Actual 1959	Planned 1960	% Change 1959-60	Planned 1961
$ 86.7	$ 53.0	$ 73.7	$ 5.2	$ 5.7	$ 3.6	0	0	$ 0.9	$ 6.3	$ 7.3	$ 6.2	$104.5	$ 81.5	—22%	$ 88.8
42.3	84.3	69.8	69.7	87.8	127.3	74.7	91.3	119.2	27.4	49.1	57.5	249.0	351.1	+41	470.8
25.8	33.6	37.2	53.9	98.2	99.3	77.6	75.0	121.0	25.8	28.4	27.9	215.4	258.5	+20	310.2
5.4	4.6	9.7	8.2	7.5	8.0	3.8	3.8	6.2	0	0.8	0.7	31.7	25.7	—19	34.7
73.5	122.5	116.7	131.8	193.5	234.6	156.1	170.1	246.4	53.2	78.3	86.1	496.1	635.3	+28	755.7
73.4	62.1	67.5	20.3	70.0	117.3	65.9	61.6	47.9	42.1	58.7	70.7	334.1	409.7	+23	459.8
233.6	237.6	257.9	157.3	269.2	355.5	222.0	231.7	295.2	101.6	144.3	163.0	934.7	1,126.5	+21	1,304.3

in European Common Market

Only 6% of the companies answering list lower labor costs as an important factor. The non-electrical machinery industry, however, does list lower labor cost as a factor.

American manufacturing concerns expect the sales of their foreign subsidiaries to rise 11% in 1960 and to outstrip their export sales from this country next year. They expect their subsidiaries' sales to climb another 6% in 1961, compared to an increase of only 4% in export sales. Every manufacturing industry except the electrical machinery and the stone, clay and glass industry expect their subsidiary sales in 1961 will increase more than their export sales.

Foote Bros goes into high gear at 100

"Geared" in every sense of the word to the remarkable growth of its home town, Chicago, Foote Bros Gear & Machine Corp in just 100 years has expanded from a shaft hanger and pulley shop into one of the nation's top producers of precision gears and mechanical drives.

Back in 1859, when native Chicogoan George C Foote opened his shop, Chicago was a muddy-streeted ramshackle collection of frame buildings that had just passed its 25th birthday as an incorporated city. The company and the city grew up together.

Just as Chicago picked up outlying areas and suburbs as it grew, Foote Bros got its share of industries along its way to the century mark.

First of these was by merger with A Plamondon Mfg Co in 1927, which became the company's Gear Division. Then, in rapid succession, came acquisition of Bates Mfg Co and Stockland Road Machinery Co, which were combined into Foote's Road Machinery Division. Next addition was Northwestern Steel & Iron Co, a carbon steel foundry.

Entrenchment, then expansion

Then the 1929 crash hit, and Foote was forced to pull all its manufacturing into a single plant. By 1940, the company was still concentrating production in the same plant, doing about $2.5 million business that year.

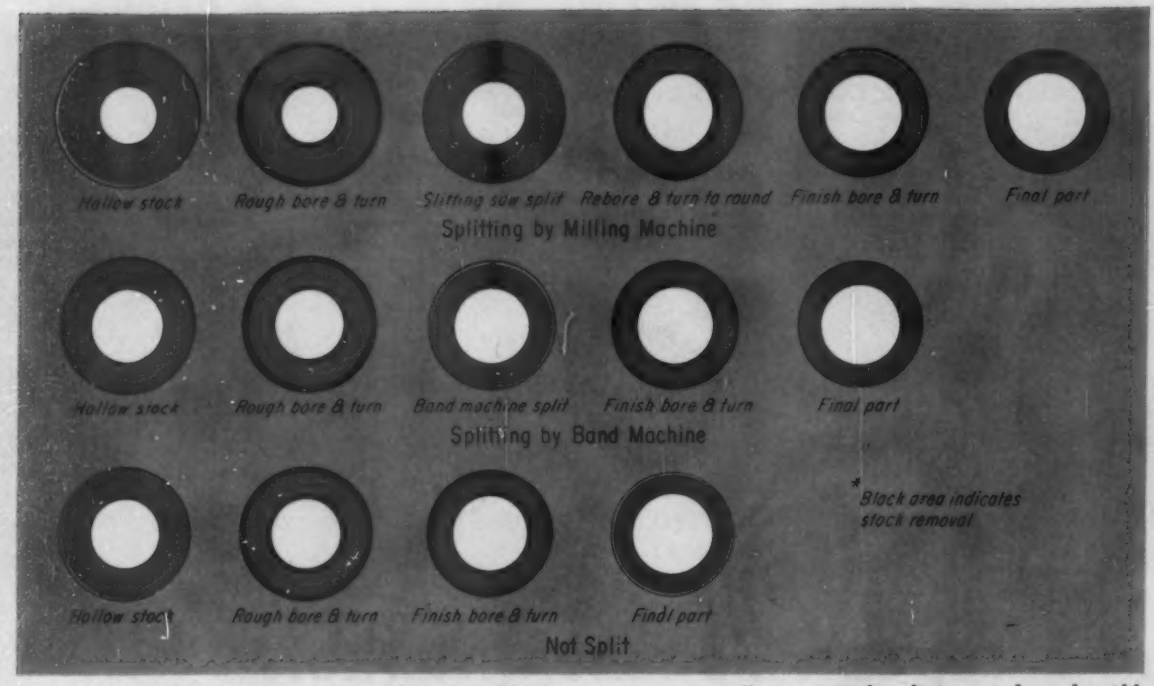
With World War II, the company came into its own, producing precision gears, pinions and parts for the Air Force. By war's end, Foote had 7000 employees, was doing an annual business of $45 million.

Sales plummeted to $5.5 million in 1945 as the war ended. Then came Korea and Foote was called on for the third time to furnish precision gears for U S Armed Forces (The first: gears for the first U S tanks in World War I). The company filled something like $20 million in war orders in 1952 alone.

Since then, Foote has managed to keep annual sales at 1952's $20 million level, despite off-again-on-again defense cutbacks. Early last year, it acquired the 60-year-old Whitney Chain Co of Hartford, Conn, maker of roller and silent chain for mining, agricultural, and industrial machinery.

In line with its expansion into new fields, Foote has just announced that it is teaming up with England's David Brown Corp, world-renowned producer of gears and machine tools, to form David Brown-Foote Gears Ltd, Canadian outlet for the products of both companies. As part of the agreement, Foote is handling Brown speed reducers and gear products exclusively in the U S.

Paralleling company growth closely has been intensive research and development of new product lines. Most recent fruit of these efforts: introduction of the Radicon line of small worm gear reducers, and the new Whitney Maximum Service Life (MSL) chain line.



Comparison of splitting techniques shows advantages of bandsaw cutting, which cuts narrower path and saves one operation over a milling cut. Wide splitting cut demands width-of-cut allowance plus OD allowance to correct out-of-round

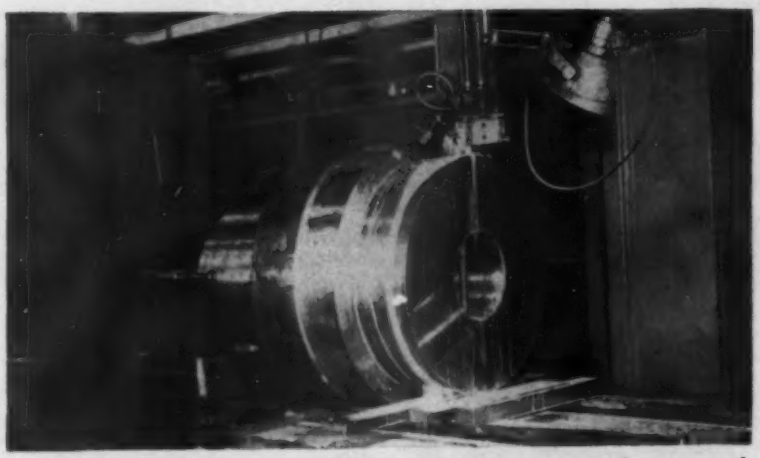
Band splitting saves a "muffed" job

By George R Reinerth,
Special process engineer,
National Acme Company, Cleveland

Somebody goofed — and the customer asked National Acme to salvage a special HSS forged bushing. The trouble was that a splitting allowance had been applied to the diameter instead of the radius, so only half the intended allowance was left. National Acme was consulted because of considerable experience with splitting by bandsaw.

The idea was to split the forging with as thin a cut as possible, and thereby save the expensive 2000-lb workpiece. The part was almost out of size range for the shop, but a setup was made on a DoAll Contour-matic with 32-in. throat depth. The work was partly supported by the table of another bandsaw—the two tables lashed together with rails so both could be powered.

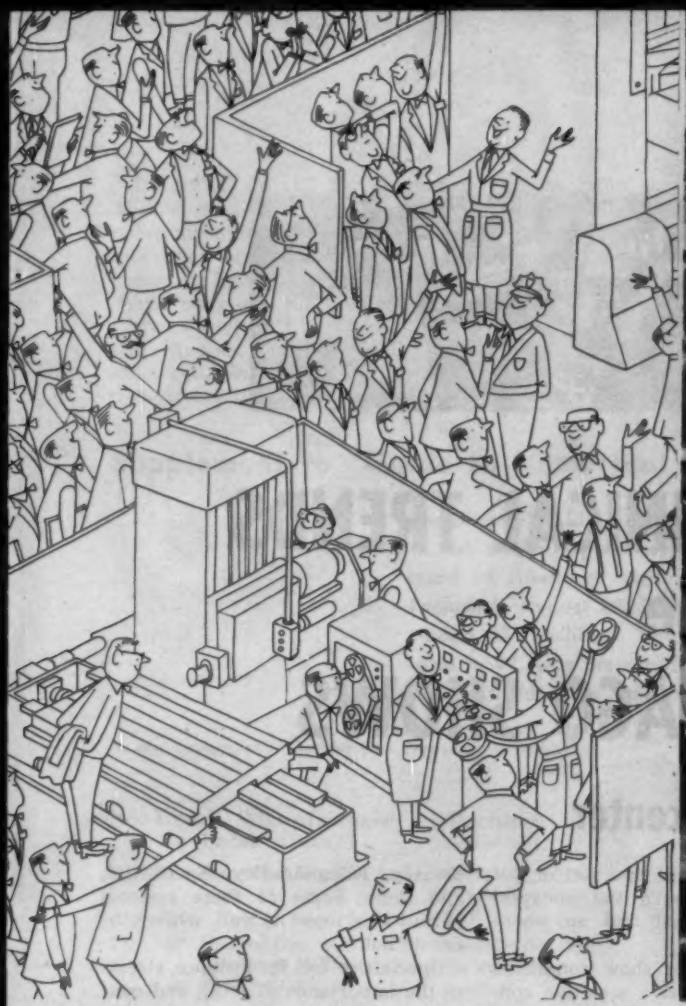
The 30-in. cut was made to ± 1/32 in., which saved the part. A chain sling held the work as the blade cut through. Floor-to-floor time for the job including setup was 13 hr—within an hour of estimated time.

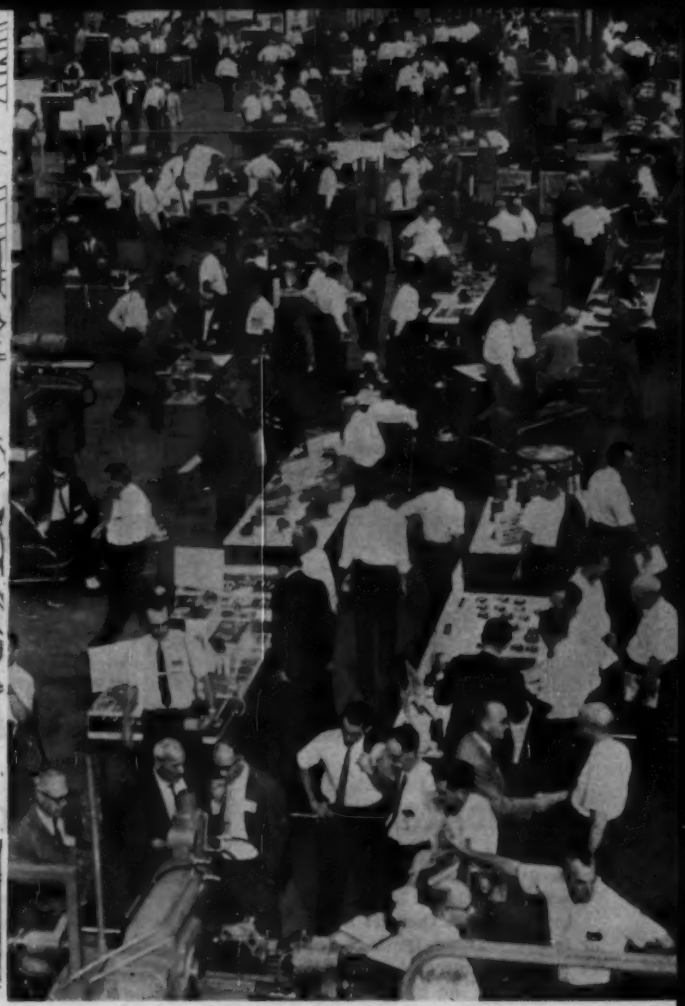


One-ton HSS bushing is split on coupled DoAll Contour-matics. Work rests on rails between the tables; is fed by power from both tables. Demon blade 1 in. wide, 3-pitch, 0.05-in. set, operates at 200 fpm and 1½ sq in./min to cut through in 8 hr

Results were as expected, and the bushing was salvaged because the width of the splitting cut by bandsaw was less than half the normal cut with a slitting saw on a miller—and this made up the error on the original allowance.

Similar splitting techniques, but not normally on so large a part, are applied to elements for single and multiple-spindle automatic screw machines and chucking machines. Revolving arms for Geneva-movement spindles, for example, are slit without extensive tooling and in minimum time.





CHICAGO SHOW REPORT

The Machine Tool Exposition — 1960, held at the Chicago International Amphitheatre from September 6 to 16, lived up to its advance billing by displaying more new controls of all kinds for machine tools than at any other show in history.

Numerical control was the most spectacular example. Because of its dramatic nature, some 79 machine tools equipped with it drew top attention of the estimated 130,000 metalworking men who visited the exposition. Another 20 numerically controlled machines were a main attraction at the Production Engineering Show at the Navy Pier where controls and accessories were shown. This emphasis on controls also was evident at the International Machinery Show at the Coliseum. Both the Navy Pier and Coliseum shows ran concurrently with the Machine Tool Exposition.

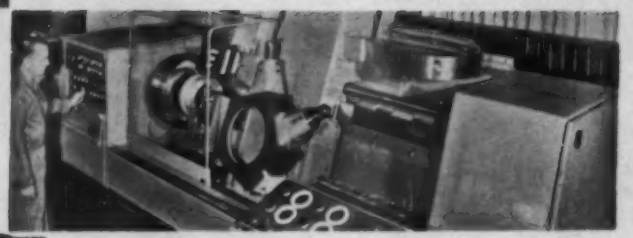
New and interesting controls were by no means confined to numerical control. They extended from various forms of automatic control to simpler, easier-to-operate hand controls. However, three aims were apparent on the part of builders to (1) attain greater flexibility in machine operation, (2) to reduce to a minimum what an operator has to do to secure repeatability of dimensions on successive workpieces, or (3) to rely on the machine to perform a complete operation by itself.

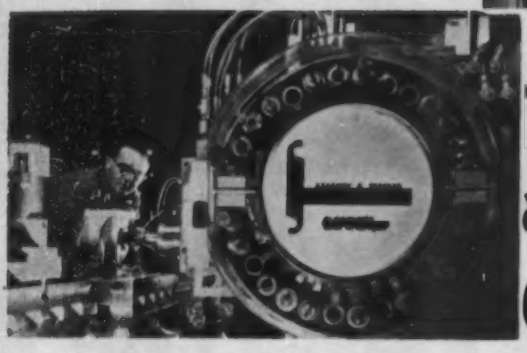
The vast improvements made in machine tool design and operation since 1955, the date of the most recent Exposition, lured to Chicago the nation's blue-chip list of machine tool users, despite the fact that the early days of the Exposition were steaming hot and were a real test of human endurance. What's still better, a number of builders reported impressive inquiries that were "about to be converted into orders." At the end of the Exposition feeling was running high among machine tool builders that the long drought in new business was coming to an end.

From Europe and other parts of the world came metalworking men to see what's new in the U S machine tool industry's products.

Machine tool builders have been getting a substantial share of their total bookings this year from abroad.

More than ever before, the Machine Tool Exposition resembled a mammoth machine tool shop at work. For this time the gimmicks had been banned—the giveaways and the beautiful models. No "flashy" exhibits were permitted. All attention was concentrated on the $25 million of machine tools in the 300,000-sq-ft space—and rightly so—the 1960 Exposition was an operating show for operating men.





TECHNICAL TRENDS at the CHICAGO SHOWS

Numerical control is at stage center

A great many men at Chicago were like boys in a huge, fantastic toy shop. On the one hand they certainly wanted to start applying numerical control to their own problems, but on the other hand they wondered where the money was coming from to pay for it. But not all the visitors to the exhibits appeared worried about the latter problem.

In fact, many metalworking executives arrived at the exposition expecting to pay whatever was necessary—and they didn't bat an eye at price tags well above $100,000.

Of the 99 machine tools operating under some degree of numerical control, however, more than three-quarters of them did not have steep price tags, and about half of the control systems were in the $7,000 to $15,000 range. One two-axis control system was offered at $3,500.

The most significant result of this exposition was that thousands upon thousands of the most responsible men in metalworking saw a great variety of the tasks normally requiring exacting operator skill readily accomplished by numerical control. Some of these men devoted hours to studying a single installation. They got a much-needed education and they were deeply impressed. Here were undreamed of savings. One visitor put it this way: "After all, an efficient numerical-control system will operate for 30¢ an hour—and that's the cheapest skilled labor you'll find anywhere in the world."

Operating under show conditions is the cruelest test a sensitive control can be put to. These systems stood up to the test surprisingly well, even considering some efforts "above and beyond the call" by their keepers. If the 100+ degree temperatures during the opening days of the show were hard on the people, they were doubly hard on the controls. More than one builder turned his fans from the customers to the controls. And extraordinary voltage fluctuations didn't help either.

Jones and Lamson's Dave Smith was rather proud. He had built both a voltage control and a half-ton room air conditioner into the control cabinet of J&L's new turret lathe, operated it without difficulty.

While tape was predominant as the input to these numerical control systems, and the one-inch, eight-channel tape standard appears to be well accepted, one heretofore hazy point was clarified for many potential customers: Tape is not essential to a system providing numerical control. It is simply one form of information input. There are others.

Non-tape input is possible on systems supplied by Carlton Controls, Fosdick, Giddings & Lewis, General Electric, Seneca Falls, Warner & Swasey, Allen-Bradley, Specialties, and Pope. Some of these systems permit tape input as well, while others do not.

Specialties, Inc, for instance, stresses the importance of setup and control at the machine. It provides programming via stainless-steel keys perforated in a binary pattern and placed in a drum reader. End points and feed rates for every motion are set by dials on the control panel and the keys determine order of selection as well as auxiliary functions.

Similarly, the data input to the Seneca Falls Model LQ automatic tracer lathe is by dial, with tracer control as an auxiliary function. Because of this simplicity, many visitors appeared to more readily understand the dial-input systems. In the same sense, a system need not be electronic, or even electrical, to provide numerical control.

Moog Servocontrols, Inc, demonstrated its two-axis positioning system on a Burgmaster turret drill. This system is pneumatic-hydraulic and the only electricity in it operates the tape-reader motor, the hydraulic pump, and the machine-tool spindle. Air blown through the holes in the tape opens small diaphragms in a unique hydraulic valve, and hydraulic pressure controls the valve to select the desired motion, again obtained hydraulically. The system, designed to position within ± 0.001 in., readily repeats within ± 0.0005 in.

Burg Tool Co and The Cincinnati Milling Machine Co, with almost a dozen machines each, had the largest quantities of units. However, each company had a unique difference. While Burg was represented by ten turret drills utilizing General Electric, Hughes, Ferranti, and Moog servo-controls, Cincinnati had its own Acramatic control systems on an engine lathe, three vertical drills, a turret drill, a Hydro-Tel, a boring machine, a traveling table miller, and the new grinding machine. At another location, a Cincinnati miller was equipped with a Wang Laboratories Weditrol system.

Both Landis Tool Co and Cincinnati Milling Machine Co demonstrated new numerically controlled cylindrical grinders. With Acramatic 2-axis rate-controlled positioning on the Cincinnati grinder, the sequence and type of operation to be performed, table reversal points, table and wheelhead movements, truing a predetermined amount from the wheel, and cycle stops are all numerically controlled.

The Landis Tool Co grinder is con-

Supplement to "Guide to Numerical Control at the 1960 Chicago Shows"

The original guide, which proved so useful to visitors to the shows, appeared in the Chicago Exposition Issue of American Machinist/Metalworking Manufacturing, August 22, 1960, pages 191 to 194. It included 85 machines. This supplement, bringing the total to 99, was prepared in Chicago by the editors and distributed to visitors there.

At the Amphitheatre: Machine Tool Exposition — 1960:

No.	Booth	Manufacturer	Machine	Control System: Function	Model	Builder	Input
70	923	Barber-Colman Co	engine lathe	Positioning*		Barber-Colman	tape
71	823	Burg Tool Mfg Co	2BHTL ¾ in. 2hp, 15 x 26 table 6-spindle drill	Positioning	Mark II	General Electric	std tape
72	928	Cimtrol Div, Cincinnati Milling Machine Co	special index drilling machine	Positioning	Proportional dividing Acramatic	Cincinnati Milling	std tape
73	632	Cleereman Machine Tool Corp	Spindlemaster 30 tool changer 18 x 36 posit tble	Positioning	Mod Mk III	General Electric	std tape
74	632	Cleereman Machine Tool Corp	layout drill 18 x 36 posit table	Positioning	3-axis	Allen-Bradley	std tape or dial
75	632	Cleereman Machine Tool Corp	24 x 34 posit table	Positioning	Tele-Probomat	Warner & Swasey	std tape
76	946	Ex-Cell-O Corp	Model 758 Numera-Trol dble end boring machine	Positioning	4-axis	Rheem Mfg Co	std tape
77	823	Landis Tool Co	cylindrical grinder	Positioning	Probomat	Warner & Swasey	std tape
78	749	Onsrud Machine Works	pin router	Positioning	2-axis	Tape Control Corp	tape
79	482	Pope Machinery Corp	double-end horiz boring machine	Positioning		Pope	dial

The following companies exhibited numerical control systems independent of machine tools: Carlton Controls Corp (1 system), Cimtrol Div of Cincinnati Milling Machine Co (4 systems), and Control Instrument Div of Warner & Swasey (2 systems, working demonstrations).

CORRECTION: Line 21 in table published August 22, the Cincinnati Lathe & Tool turret drill has a 3-axis Acramatic control system.

At the Navy Pier: Production Engineering Show:

No.	Booth	Control Builder	Model	Control System: Function	Machine	Input
17	216	Allen-Bradley Co		Positioning	positioning table	std tape
18	419	Specialties, Inc	Specialmatic	Positioning	Jones & Lamson turret lathe	key
19	100	Square D Co	Rapac	Positioning	24 x 24 positing table	std tape
20	535	Tape Control Corp	Command control	Positioning	mock-up	5-channel tape

NOTES: "std tape" means standard 1-inch, 8-channel punched paper or plastic tape. * after the word positioning means modified to provide simple profiling.

CHICAGO SHOW REPORT

Numerical control (continued)

trolled by a special Warner & Swasey Probomat system. This system positions the work to grind step shafts and controls wheelhead movement, as well as providing sequencing and cycle stops. In addition, the third "axis" of control data is fed to a special size-control gage developed by Airborne Instruments Co. To allow for changes in step diameters without manually resetting the gage each time, the gage is equipped with a transducer. The required size is established by data from the tape—fed to an input transducer, this size is reached when the transducer output from the gage balances the input signal and the wheel retracts.

If machine tools are permitted status, then the one machine that has risen on the metalworking "social" scale as a direct result of numerical control is the turret drill. Not only is this versatile machine growing in stature, but in size and capability.

Burg Tool Mfg Co showed a bridge type turret drill with a two-column superstructure. Under numerical control, the head travels four feet and the table travels five feet over a solid base. With a 15-hp motor, the machine will do most secondary operations, including drilling to a 2-in. depth in steel.

The Fosmatic 32-spindle turret drill exhibited by The Fosdick Machine Tool Co combines two control systems. The table carrying the work is positioned by a General Electric Mark II (modified) control while the downfeed or hole depth is determined by Fosdick's system.

Turret drilling machines were shown by Cincinnati Lathe, Avey, Brown & Sharpe, and Cleereman in addition to the foregoing. The Fosdick and Cleereman machines are not turret drills in the same sense as the others. Both of them offer much larger tool capacity and, in a sense, contain integral tool changers. However, they do fit in with the turret-drill concept.

Cincinnati Lathe's 6-spindle turret drill, controlled by a 3-axis Acramatic system, has zero shift on the pendant to correct for variations in workpiece.

Tool changers cut downtime

To minimize loss of productive time for tool changes, a number of machine tool builders have developed means for either (1) automatically interchanging tools between a storage magazine and the work station or machine spindle, or (2) indicating with programmed identification numbers or illuminated signal lights the next tool to be used.

Best known among the automatic tool changers exhibited were those on the "Milwaukee-Matics" shown by Kearney & Trecker Corp and on the turret punch presses shown by Wiedemann Machine Co. These devices have been described a number of times in *AM/MM*. The tool changer magazines on the Milwaukee-Matics each hold 30 preset tools in coded holders, while the Wiedemann turret punch presses carry punches in an upper horizontal disk and mating dies in a lower disk—the two disks being positioned to straddle the horizontal workpiece.

On the Model 21 vertical single-spindle, rail-type machining unit demonstrated by Sundstrand Machine Tool, tools preset in holders are mounted vertically in a 20-station, 24-in. OD drum suspended from a slide attached to the spindle head. When tools are to be interchanged in the spindle, the tool magazine, or drum, is moved under the raised spindle and the used tool is replaced in its numbered position. The drum is retracted, rotated to bring the next tool into loading position, and then repositioned under the spindle. There the tool, in its holder, is drawn up into a collet chuck. Finally, the drum slide is withdrawn to clear the rotating spindle.

An entirely different tool exchange arrangement was provided on the horizontal boring, drilling and milling machine demonstrated by the Lucas Machine Div of The New Britain Machine Co. This numerically-controlled machine has a vertical plate with keyed bushings in which the tools, preset in taper-shanked holders, are stored. Under control of the punched tape, the machine spindle is centered with a specified tool-storage bushing, stopped in a predetermined radial position, then moved forward toward the plate—either to replace a tool in its bushing, or to pick up the next tool to be used. A spring-loaded detent holds the tool assembly in its storage bushing unless the tool shank is gripped in the machine spindle by an air-actuated collet in the spindle nose. One of these machines, recently completed, has a tool storage rack with storage bushings for 84 tools.

With the "Milwaukee-Matic" and the Sundstrand tool storage magazines mentioned above, radial location of the tool holder with the spindle nose is not important. However it's necessary in the Lucas arrangement to stop the spindle at the same rotary position each time, since a cross key in the tool holder must enter a key slot across the spindle nose to insure a positive drive for the tool. This is accomplished with a relatively inexpensive (approx $3500) spindle orienting system which employs a proximity switch that acts to stop the spindle when it has been slowed to its lowest speed, and a solenoid-actuated plunger which enters a tapered slot in the stopped spindle.

Entirely different tool changer systems were developed for the new "Spindlemaster" numerically - controlled drilling, tapping, boring and milling machine exhibited by Cleereman Machine Tool Corp, and the "Fosmatic Turret" machine shown by Fosdick Machine Tool Co. In both of these machines, the tool-holding magazines are large disks supported from and rotated about the machine column, below the drive spindle head. In other respects, the two machines are quite different.

The 50-in. OD tool magazine on the "Spindlemaster" has 30 vertical tool-support holes spaced around its periphery, in each of which can be set a toolholder with a preset tool. Toolholders are retained in these holes with springloaded pins, which are retracted by vertical motion of the toolholder body inside its sleeve when it is moved into or out of the magazine by the machine spindle. Pickup of a toolholder by the spindle, or its return to the magazine, is accomplished automatically. Downward movement of the spindle moves the toolholder out of its supporting hole and toward the workpiece on the table below.

In the Fosdick "Fosmatic Turret" machine, 32 spindle-and-quill assemblies are spaced vertically around the periphery of the 56-in. OD, 3-in. thick magazine disk. When a spindle unit has been indexed under the main drive spindle, the magazine-supported spindle is locked to its driver with a magnetic clutch.

On a Natco tape-controlled drilling, tapping and milling machine, demonstrated by National Automatic Tool Co, a 36-in. OD vertical tool magazine or drum supports 32 tools preset in holders.. The drum is indexed according to commands from the punched tape, to present at a pick-off station the next tool to be used. When a tool change is signaled, the machine operator removes the tool from the machine spindle and lays it aside temporarily. Then he picks the next tool from the magazine and locks it in the spindle nose. When he has actuated a cycle start button and the machine is at work again, the drum is turned to position (in front of the operator) the station for the tool just removed.

As many as 9 tools, locked in preset holders, can be stored in the so-called "fool-proof" tool rack used with the Model 2N "Edlund-Matic" layout drilling machine exhibited by Edlund Machinery Co. Each tool adapter is keyed to prevent its being placed in the wrong socket.

A somewhat similar arrangement is used by Leland-Gifford Co on the general - purpose, numerically - controlled drill press it demonstrated. It differs principally in the use of a color code on the toolholders, storage sockets, signal lamps and spindle stop dial positions—to help the operator make sure he is using the tool called out by the tape. The tool control system used by Famco Machine Co on a numerically-controlled vertical milling machine had a similar arrangement, but did not use the color coding.

On the numerically - controlled, horizontal-bar machines demonstrated by DeVlieg Machine Co and by Portage Machine Co, tools to be used next in programmed sequences are indicated by illuminated operation or tool numbers on the control console.

Demonstrated for the first time at the Production Engineering Show was a recently developed automatic tool changing system designed by Scully-Jones and Co and its subsidiary, Scully-Anthony Corp, for use on tape-programmed, numerically-controlled machines. It is claimed to accomplish tool changes in approx 3 sec, and makes possible the proper selection of any one of more than 65,000 possible tool combinations.

50 tracer controls prove value

A wider range of tracer controls than ever before was available at the Chicago shows. This reflected the growing interest in tracer controls and the increasing percentage of lathes sold that are equipped with some form of duplicating system. On lathes, shapers, and milling machines, there were about 50 tracer systems, ranging from simple hand-control hydraulic tracers to systems operating with constant feed, constant speed, and in combination with numerical positioning.

One combination numerically and tracer-controlled engine lathe was the American Model 2509, a 50-hp lathe with numerical control for point-to-point cuts and an electronic tracer for contours. The 360° tracer uses flat templets. The tracer-numerical combination is also incor-

The candid camera at the Exposition...

A P Nunes, assistant equipment engineer, and Ernst Krippendorf, superintendent of manufacturing, United Shoe Machinery Corp, with Thomas F MacLaren (center), general sales manager of the Machine Tool Division of Brown & Sharpe Manufacturing Co

Robert W Asquith, chairman, Asquith Machine Tool Corp, Halifax, England, with Walter K Bailey, president, and Lester M Cole, vice president in charge of sales, The Warner & Swasey Co. Asquith and Bailey are top officers of Warner & Swasey Asquith Ltd of Halifax, England

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Tracer controls (continued)

porated in the Seneca Falls Model LQ automatic tracer lathe.

Modulated feed to maintain constant feed marks on difficult contours was introduced by Lodge & Shipley on a 2013 Powerturn lathe with a 90° Copymatic.

A dimensional 180° tracer demonstrated by Jones & Lamson on a 5-in. ram-type turret lathe can be used for both axial and face tracing and holds a constant feed rate. The American 2013 90° hydraulic tracer lathe has a modulated feed and is designed for roll turning.

Constant cutting speed is provided on the Lodge & Shipley 10-in. Hi-turn manufacturing lathe with a 45° tracer. Constant cutting speed controls are also available on Springfield lathes. The lathe demonstrated was equipped with a Honeywell tracer control.

An electro-hydraulic tracer specifically designed for roll turning was introduced by Monarch. Hydraulic motors on the leadscrew and cross-slide replace the former electric drive and the slides operate simultaneously with an accuracy of trace better than 0.001 in.

Rapid traverse on the tracer slide is provided on the new 60-hp Sidney 3220. The tank has been placed on the tracer slide on the 45° tracer on the Lodge & Shipley 2013 Powermatic.

Full 4-axis trace control is provided on an Ekstrom, Carlson open-side profiling machine. A 3-dimensional True Trace hydraulic control provides control of position and rise and fall of the head. A second True Trace control handles head tilt.

A range of tracer milling machines shown by Famco included one with 3D manual True Trace, one with automatic True Trace, and a third with the Honeywell automatic electro-hydraulic tracer.

Cone Automatic introduced the Pilot automatic multi-cycling copying lathe with a rotary indexing templet.

Jones & Lamson showed three versions of the modular Model 30 automatic tracer lathe. One machine was equipped with multiple tooling (with different tools being used in sequence on the tracing cycle). All have graduated cam rings on the set-up drum. Once settings have been recorded on the setup chart for a particular job, the complete machine can be set up in about five minutes.

Grinders reach for tighter tolerances

Grinding machines are digging deeper into the range of tolerances under ten thousandths; some of them with refinements and special devices, and a few with numerical control—for greater repeatability and reliability that reduces inspection costs and reworking.

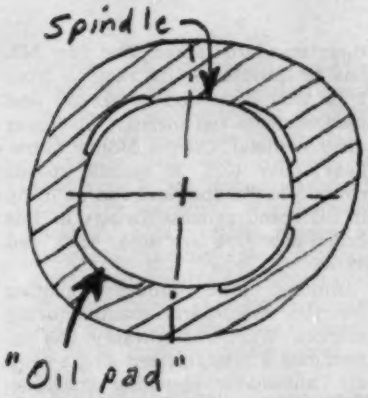
Two N/C grinders at the show aim at cylindrical work. Landis Tool has a cylindrical machine for step grinding, controlled by Warner & Swasey Probomat on wheel and table motions. Size control is by Airborne Instrument equipment that gages work diameter with a workriding pin. Electrical signals from pin feedback and from the machine setup panel are balanced until work size is exactly the desired size.

A Cincinnati Milling cylindrical grinder is equipped with an Acramatic N/C system developed by Cincinnati's own controls division. The machine grinds two ends of large shafts, producing steps by roughing infeed passes that overlap where the steps are longer than wheel width. Longitudinal finishing passes eliminate any roughing marks.

The X axis of the work is mechanically set, but the Y axis is checked and reset several times during the cycle, in particular just before the finishing pass. This is automatic and included in the cycle.

Numerical control is also applied to a Fosdick jig grinder, a Thompson contouring grinder, and an Ex-Cell-O combination machine that also turns and bores.

Brown & Sharpe has approached tight tolerances on its No. 2 universal cylindrical grinder with a "Hydrostatic" headstock. This balances the work spindle between four opposing "oil pads"—really four unusually wide oil grooves that almost span half the spindle circumference. Compensating oil pressure



B & S "Hydrostatic" headstock floats spindle in "oil pads"

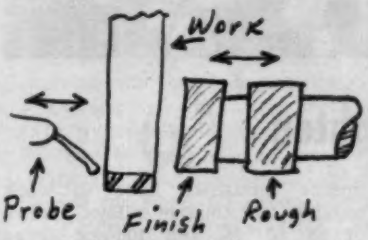
at 300 psi or more recenters the spindle if it shifts. This allows consistent work centering within ±7½ millionths and work-diameter tolerances to 25 millionths.

"Dry-base" grinder construction by Blanchard is typical of the growing necessity to keep coolant, and its fluctuations in temperature, away from the work and powered spindles. Coolant is located in a reservoir outside the machine base. Besly Welles uses a three-deck Barnes coolant settling and cooling tank for the same results, and Heald and Lees-Bradner, among others, also have similar isolation systems.

Higher grinding speeds are being accented by Norton—8500 sfpm at the wheel instead of the more conventional 6000. The company is now building both machines and specially graded vitrified wheels to the new specification.

Faster machine action is the advantage of Heald's 190A internal grinder, which has two wheels on the spindle, one for roughing, and one for finishing. The wheel nearer the tailstock is the finishing wheel.

This sounds backwards, but it is placed there because the gaging probe that enters from the tailstock end can follow the finishing wheel as it backs off.



Two-wheel internal grinder moves fast so gage probe can follow

Belt-grinding advances at the show indicate evolutionary changes. Sundstrand's belt-conveyor surface grinder has two belts, one a grinding belt, the other a work-carrier belt that moves flat parts over an electromagnetic section in the table directly under the grinding belt. Magnetic pull is adjusted to fit the work to prevent smaller parts from flipping as they cross flux lines.

Eastern Machine Screw's Loungway rise-and-fall belt machine with twin heads follows a templet to make two roughing cuts and one finishing pass per cycle over the work. An air cylinder raises the head as the finishing belt passes over the work, then allows the roughing belt to cut on the out stroke, then both heads touch the work on the return stroke.

Hill-Acme belt machines have improved hydraulic machine motions, combined (say company specialists) with better belts with improved backing—in some cases paper.

Tooling highlights at the show included Oliver's cam-controlled cutter grinder that has a rise-and-fall motion including, a shift for wheel dressing with a diamond. The cam is easily interchangeable.

Gardner tooling for die castings with non-round shapes consists of big three-hole plates, with the holes contoured to fit the work. Parts are carried around the disk wheel one revolution at lower cost than with indexing work carriers.

Construction trends in grinders lean to heavier bases; more rigid, stiffer sections where they count, and weldments in some cases where they can be applied. Hydraulic equipment is generally more carefully designed than in the past.

Interesting note: One builder, Parker-Majestic, is marketing a stripped-down internal (only) grinder aimed to cut into the used-machinery market where its moderate price ($5300 for the basic machine) is little enough more than the cost of a used machine (perhaps $2500 to $3000 for an old machine, including rebuilding cost) to tempt a potential buyer.

The candid camera at the Exposition...

Robert V Thompson (center), superintendent, National Forge Co, talks with Richard E LeBlond, (left) president, and Daniel W LeBlond works manager, The R K LeBlond Co

Frederick V Geier (right), chairman of the board, with Philip O Geier, Jr, (left) vice president and assistant general manager, and Swan E Bergstrom, president, The Cincinnati Milling Machine Co

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Turning tolerances tighten

"It's like trying to fill an open-end straight." That's the way one lathe builder described the current development of bigger and more powerful lathes at the same time that smaller, more precise lathes are being introduced.

On one hand there is a growing market for heavy lathes capable of high stock-removal rates. But interest in small precision lathes that can turn out small parts efficiently is as great or even greater. Interest in these contradictory aspects of turning is largely responsible for the numerous lathes of both extremes at the Show.

Among exhibitors showing heavy-duty turning equipment (along with their "standard" lines) were American Tool Works, Sidney, Lodge & Shipley, Springfield, Monarch, and LeBlond.

At the other end of the turning spectrum, such builders as Warner & Swasey, Brown & Sharpe, National Acme, and Bardons & Oliver were among those who exhibited lathes specifically designed for the high production of small parts.

The big demand in *both* areas is for increased accuracy. All industries—tightening up tolerances—are asking for turning equipment that will give finishes and accuracies usually obtainable only with grinding operations. For example, users are asking for lathes that can turn diameters as close as 0.000020 in.; moreover, they want finishes of 10 micro-in. Machine builders can meet these demands, but special bearings are necessary, and there must be enough weight and rigidity to eliminate all vibration.

The market for heavy-duty lathes is expanding in at least two major areas: Steel mills need to remove metal faster, and the aircraft and missile industries have to work tougher and tougher alloys. Lathes of 50, 60, 75, and 100-and-higher horsepower ratings are in demand—not only as new production tools but also as replacement for worn or obsolete equipment. As a result, these new lathes have bigger shafts and headstocks, wider gears for maximum horsepower efficiency (especially in the lower speeds), and of course plenty of beef.

Missile builders and their suppliers are also showing considerable interest in lathes with more moderate power but with large swings (100 in. and more). In addition, they want increased dimensions between centers. Here, too, the maximum in rigidity is required to meet demands for closer-tolerance turning.

Some users, who have to turn the tough new alloys, are dropping speeds to as low as ¼ rpm with dc variable drives, which also provide an infinite variety of low speeds. Some of the new alloys with hardness rating as high as 80 R_c have been turned successfully with cemented-oxide tools — here again, heavy, rigid lathes do the job. Carbide tools are very successful at removing metal at high rates with this equipment. But the ceramics are fast coming into their own, especially in light finishing cuts. Turning speeds around 8000 sfpm are not unusual with these tools.

One of the new heavy-duty lathes shown for the first time is the American 4025 Pre-Select engine lathe, which has a 100-hp main drive motor and a spindle-speed range of 6 to 750 rpm. Another is the Lodge & Shipley 2516, especially designed for cutting with carbides and ceramic tools. And Springfield Machine Tool Co found visitors more attracted to their new 2516 Model ML than to their standard lathes. The new ML has 36 spindle speeds, ranging from 7 to 1050 rpm, and 66 thread and feed changes (an increase of 6 over older models). On the Sidney extra-heavy-duty 4025, 36 spindle speeds cover 5 to 800 rpm and run at 75 hp in all speed ranges. Swings in this brand-new line are 40½, 45½, and 49 in.

Among lathe builders shooting for the small-parts manufacturing market, Warner & Swasey has introduced a miniaturized single-spindle automatic chucking machine. This O-AC has a nominal working range that handles work of about 3-in. dia by 3 in. long. Another W & S innovation, the No. 2 turret lathe, was specifically designed to meet the higher accuracies required in small parts, with precision indexing controlled by a Gleason coupling. A fully universal cross-slide and square turret, together with rugged construction, provides the features of a turret lathe combined with the precision of an instrument lathe.

Current high demand for machines of this type comes from such users as business-machine producers, computer builders, and electronics manufacturers. Bardons and Oliver also showed a No. 2 turret lathe with such operating features as single-lever, electric start-stop-reverse of the spindle, single-lever high-low spindle control, and single-lever spindle-speed selector. Spindle capacity is 1 to 1¼ in., with a swing over the bedways of 13½ in.

Another precision lathe, the Acme-Gridley 7/16-in. RA-6, is a multiple-spindle automatic bar machine that was expressly developed for making miniature and sub-miniature parts.

Still another machine of this type, the Monarch 10-in. Model EE lathe, is useful for precision turning, boring, facing, and threading of small jet-engine, missile, instrument, electronic, and camera components. Basic components include a bed mounted on a cabinet base, a built-in oil pan, and a 5-hp, 100-to-1 variable-speed electric drive with magnetic switch and pushbutton station. Swing over the bed is 12½ in., and swing over the cross slide is 7¼ in.

Not all the interest at the Show centered around either very large or very small lathes. One heard a great deal of comment, for example, on lathes equipped to do combination operations. A new 6-spindle Acme-Gridley (1¼ in.) combines turning and hobbing. And the new 900 Series exhibited by Frauenthal

Div of the Kaydon Engineering Corp can do contour grinding and turning (as well as conventional) work. The Frauenthal machines are vertical, to eliminate deflection normally encountered when large, unsupported parts are machined in a horizontal position. This vertical design also simplifies loading, speeds checking, and speeds centering of such parts as large rings. Direct-current drive with potentiometer control provides accurate and variable worktable speeds.

Still another new development—increased emphasis on building-block construction — was evident in a new line of modular machines by Cleveland Hobbing & Machine Co. These are made up of components that can be put together to form a wide variety of turning machines: chuckers, turret lathes, profilers, and threading lathes. For example, a pedestal lathe can be made up from components that include a compound saddle, a 6-in. cross slide, rocking cross slide, axial profile slide, face profile slide, bar-feed mechanism, and others. On this pedestal lathe, available headstocks are single- and two-speed up to 5000 rpm, 8 and 16-speed up to 3000 rpm.

A new approach to turret design was exhibited by Jones & Lamson on an automatic turret lathe. The hex turret has two T-slots that run vertically the length of the turret face. Pilot holes are provided for centering the bottom tool, and the upper tool can be positioned up and down the face as required. A Geneva motion permits 1-sec indexing time.

Developments in turning were not wholly confined to American firms. Visitors to the Coliseum saw automatically programmed lathes designed for small lot production by Le Progres Industriel, Jones & Lamson Machine Co, SA, LaPointe Lang chucking and engine lathes built in Scotland, Gisholt Cri-Dan threading lathes, and Sigma hydraulic tracer lathes among others.

Turrets and tape boost drilling output

Buyers looking for greater productivity in drilling machines hit the jackpot in the Amphitheatre this year. Turret drills, in all shapes and forms, popped up everywhere, with five builders introducing new models —most of them numerically controlled.

Cincinnati Lathe & Tool and Burg Tool introduced turret drills with three-axis tape controls. Whereas most of the two-axis control systems provide X and Y positioning of the table, the three-axis systems also control hole depth (the Z axis). Cincinnati Lathe's Cintimatic turret drillpress carries a six-spindle turret, as does the Avey Turret-Dex. Burg showed a 6-spindle turret drill and an 8-spindle rail-type turret drill. All four of these machines are numerically controlled.

Another version of a turret drill was that introduced by Fosdick. The Fosmatic carries 32 tools (each with its own spindle) in a horizontally rotating drum. Saddle and table positions, spindle traverse and feed depth, tool selection, and many other auxiliary functions are controlled through a numerical control system made up of a modified General Electric system and a Fosdick control system.

Cleereman exhibited its numerically controlled Spindlemaster, a multi-purpose machine which also carries its tools in a horizontal drum. The automatic tool changer changes tools in less than 8.5 seconds, selecting any one of 30 tools while the table is positioning for the next operation.

One step removed from automatic tool changing is the "tool presenter" on Natco's numerically controlled drilling, tapping, and milling machine. A rotating drum, under numerical control, brings the proper tool to the operator's fingertips for each operation.

Other numerically controlled drilling machines include the overhead-rail vertical drilling and boring machines introduced by Carlton Machine Tool and Lapointe. Carlton's machine has a 66x96-in. planer-type table; the Lapointe machine has a 57-in. rotary table.

Resembling a huge radial drill mounted on a 15-ft long railroad track, American Tool Works' numerically controlled openside drilling and boring machine was shown cut-

The candid camera at the Exposition...

George H Johnson, (left) president, and George M Class, vice president, Gisholt Machine Co, talk with Ernest Tempelmeier (center), manufacturing engineer, South Philadelphia Works, Westinghouse Electric Corp

Donald H McIver (right), vice president-industrial sales, Ex-Cell-O Corp, and chairman of NMTBA's Exposition Committee, discusses numerical control with H Glenn Bixby, (left) president of Ex-Cell-O, and Robert L Strawbridge, vice president, Houdaille Industries, Inc

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ting 3-in.-dia holes in 3-in.-thick boiler plate at the rate of about two holes per minute. This machine can cut anywhere within a 15x6-ft working area.

For further descriptions of numerical control and tool changers see the sections of this report devoted to these subjects.

Not all the news was restricted to tape, turrets, and tool changers. The new radial drills are designed for increased rigidity. In addition, they feature preselection of feeds and speeds, new tapping controls, improved lubrication systems, and better feed and speed ranges.

This trend toward wider speed and feed ranges has come about because of the increased use both of nonferrous metals, which need high speeds, and of high strength steels and superalloys, which call for speeds below those on existing machines. From small sensitive drill-presses up to large radials, the trend in this direction was quite apparent.

Multi-spindle drilling machines, though showing no marked external differences from earlier models, featured many internal improvements —simplified tool changing, better hydraulic systems, greater thrust and, again, wider ranges of speeds and feeds.

The new Bickford (Giddings & Lewis) automatic upright drilling and tapping machine has a fast counterbore control, dial-type limit settings, and the capacity to drill to the center of a 29½-in. circle. Two models are available, one with a drilling cycle only and the other with the same drilling cycle plus a cycle for tapping.

Leland-Gifford introduced seven new machines including a numerically controlled printed-circuit-board drilling machine, a general-purpose numerically controlled drilling machine, and a mechanical-electrical gun drill.

The big machines were not the only ones drawing attention. Snow Manufacturing showed a line of small, standard drilling machines, all equipped with simple, lowcost loading, holding, and unloading fixtures.

Electrical-discharge machines were shown by Ex-Cell-O and by the Electrical Machining Dept of Cincinnati Milling. Ex-Cell-O's Model 244 vertical Electrospark machine can drill, pierce, trepan, or sink cavities in hard materials such as carbide.

Cincinnati's No. 2 Elektroject with ram head is capable of machining a progressive die in a single operation. The servo feed unit provides constant electrode-to-work clearance.

Sheffield's ultrasonic machines sense and compensate for tool wear.

Gear cutting speeds up

Square-cycle hobbing (see sketch) was introduced by Barber-Colman on the 1616 Multicycle hobbing machine. In normal cycles, the hob advances from the side of the gear blank and must advance at feed rate. The hob doesn't begin full cutting until the approach distance has been traveled.

In square-cycle hobbing, the hob is plunged into the gear blank. The exponential cam that controls the plunge slows the hob as depth is reached. This can cut cycle time (depending on the gearwidth and hob diameter) as much as 70%.

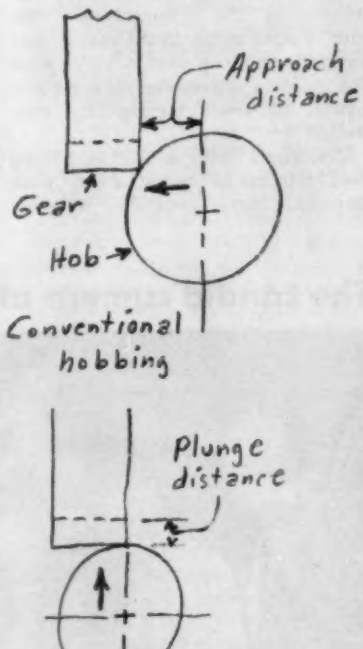
Plunge infeeding was provided by Norton-Gould & Eberhardt on the 10 HQ Hoblique machine, in this case called "Rectacycle." Cleveland Hobbing & Machine provides infeed mechanism consisting of a slidable cam and positive stop. On this machine the method is called "O" cycle.

The small hobber for fine pitch Precision 3 gears, developed by Barber-Colman, attracted considerable attention. Several of the hobbing machines of this builder have been redesigned with anti-friction bearings throughout.

The gear honing machine developed by National Broach & Machine several years ago has been completely redesigned. The machine is about half the former size, sells for less, and provides four different methods for honing hardened gears in contrast to the single method of the original machine.

Automatic loading has been added to the Fellows No. 4BGF gear finisher, a machine similar to shaving machines but with tool and work synchronized.

The Lapointe Parkinson gear planer for spur and spiral gears, shown at the Coliseum, uses the double cutting method with the slide having two toolblocks, one cutting on one stack of blanks in one direction, the other cutting on the other stack on the return stroke.



Square-cycle hobbing plunges tool into gear to cut feed time

Mills feature controls, construction, preselection

Automatic control, stronger construction, and smoother traversing were among the most significant features on the new milling machines. Numerical control, of course, was important, but there were also many tracer-controlled mills, and many with provisions for automatic cycling built into the machines.

Preselection was another important aspect. While the machine is making one pass, the operator can be selecting at least some of the conditions for the next one. Then, when the present pass is complete, he simply pushes a button, and the machine automatically makes the changes he has set into the control.

Several of these features were demonstrated on a new 6-in. table-type horizontal mill in the Giddings & Lewis booth. The unit is rugged enough to remove 5/16 in. of steel with a 4-in.-dia cutter running at 87 fpm. It has complete pendant control, including a "joy stick," and the spindle feeds and speeds can be preselected. A variety of automatic control is also available: hydraulic or electronic tracers, automatic electric positioning, and either point-to-point or continuous-path numerical control (G & L's Numeripoint or Numeripath).

G & L also showed its new DiMil for automatic contour milling and die-sinking work with the Numeripath control. Aside from numerical control, the outstanding feature of the machine is its antifriction equipment: double ball bearing nuts and ball-bearing ways to provide smooth, stickless movement.

Smooth feeding and traverse action was achieved in a different manner in the Supermill horizontal boring, milling, and drilling machine displayed at the Coliseum Show. Both the table and saddle ride on a film of air supplied by a built-in air compressor, and it's claimed there is no metal-to-metal contact.

On the Ekstrom, Carlson bridge-type profile and milling machine, the magnetic-tape numerical control was getting a dramatic workout—writing words in script on a surface that sloped diagonally across the table. In addition to numerical control, the unit boasts a dial speed milling head with continuously variable spindle speeds adjusted by turning a single dial. It has constant torque in its low range and constant hp in its high range.

Cincinnati Milling Machine's bridge-type contour milling machine was milling the complex profile of an aircraft wing beam with commands from the punched tape on Cincinnati's Acramatic, three-axis numerical control system. With 20 hp and 24 spindle speeds from 30 to 3000, the unit can do a variety of die-sinking and other operations.

DeVlieg's Tapac numerical control for its Jigmils claims to be a simpler tape control system than most, largely because of the automatic features in the Jigmil itself. Only the basic information is programmed into the tape: horizontal and vertical dimensional settings, spindle speeds and feeds, depth control setting (on the three-axis control), and tool-change warning signal. The machine lights a light to tell the operator that a tool change is required, and it won't continue until he changes it.

Kearney & Trecker was showing a new bed-type vertical milling machine with a 50-hp unit and a 72-in. table travel. The company calls it an intermediate size for shops that need a larger than normal machine but not an elephant tool.

The new Milwaukee-Matic III was announced but not displayed at the Exposition. Main features are twice as much range as the Model II in all three axes, greater power, and a tool storage magazine that can handle larger tools.

Two types of preselection were displayed that allow an operator to set up all the motions of an operation in advance. K & T's Dial-a-cycle system has a bank of 15 selector switches that can be set for feed right, feed up, etc, and dogs are set for the termination points of these motions. When a dog is tripped, the control tells the machine what to do for the next function.

The candid camera at the Exposition . . .

William Drost (center), plant superintendent, Koehring Div, Koehring Co, with Frank Moran (left), vice president, and William A Dermody, president and general manager, The Carlton Machine Tool Co

Holmes H Whitmore (left), executive vice president, and James C Hebert (center), vice president, Jones & Lamson Machine Co, with W F Green, general manager, Production Development, and L A Holder, chief mechanical engineer, The Timken Roller Bearing Co

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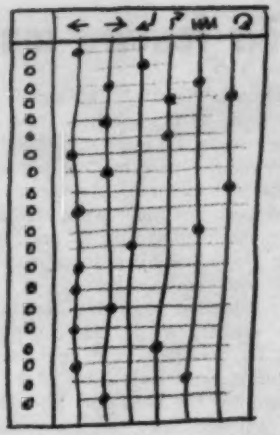


Milling-machine table motions are preselected for the whole operation with this control unit. Functions are numbered down left column and commands across the top. Metallic pegs in holes establish when the commands become effective. This rectangular grid is a feature of Somua's miller

Milling (continued)

A similar, but different system, was displayed at the Coliseum Show on a Somua milling machine. On a rectangular grid, the functions are numbered from top to bottom, and the possible commands are indicated across the top of the grid. The commands are established by inserting a metallic plug in the hole where the function line and the command intersect.

Among the small milling machines, more rigid construction and new automatic features were major features. Cincinnati Milling Machine's new 100 series is a line of small, automatic milling machines with 7½ hp for the production shop. The plain mills have automatic table cycles and a single start lever. The plain rise and fall machines employ a hydraulic cycle selector for automatic table and spindle carrier cycles. The headstock and table are a single casting instead of being bolted.

Kearney & Trecker's S12 machines are also 7½ hp and boast a unit construction. The plain knee-type mill has automatic table cycling, and the vertical knee-type unit has standard table cycle control. The No. 2 Dynamasters offered by Brown & Sharpe have more rigid construction, and automatic cycling in universal, plain, and vertical knee-type machines.

Another B & S machine, the Numericam, is a 5-hp numerically controlled cam mill that can handle cylindrical, conical, and flat master cams. A GE Mark II positioning control locates table to 0.0001 in., and the cutter makes a series of plunge cuts to depth stop at the positions established by the numerical control.

In Van Norman's 3-hp 1RQ, an all-purpose miller, the head not only swivels for horizontal, vertical, and angular milling, but the quill-type cutter head can also drill, bore, and ream to a depth of 4 in.

Tapping and threading

If crowd size is a measure of interest, then thread rolling (including spline rolling) seems to be the significant development in threading at the Chicago Exposition.

Landis Machine Co demonstrated a variety of thread rollers. One of these machines, with segmental dies, was rolling two threads of the same or different diameter and pitch in one pass. On double-end studs, one thread is produced in each one-half revolution of the dies. In 8640 steel, ½-in. dia, threaded 1½ in. on both ends, 20 and 13 pitch respectively, production is 103 pieces per min.

Involute splines of 30-degree pressure angles, serrations of 45-deg pressure angles, and roll finishing involute gear teeth are possible with equipment demonstrated by Reed Rolled Thread Die Co.

Accurate finishing of involute gear teeth by rolling is an outstanding advance in the form rolling field. A wide range of previously cut gears can be finished by the Reed three die cylindrical thru-feed principle at very high production rates. In one example shown, a spline formerly requiring hardening after cutting is rolled with sufficient workhardening to eliminate the heat-treat operation. Conversely, by control, involute burnishing improves the surface finish from 300 to 30 mu-in. rms, using thru-feed, with no change in the hardness.

While the machine was not new, there was considerable interest in Landis Machine Co's leadscrew tapper. This is the machine in which the leadscrew is cut at the end to provide self-tapping and cuts the thread it will follow.

Boring machines

Accuracy, rigidity and, in cases, surprisingly low cost were the outstanding features of the various styles of boring machines on display at the Amphitheatre. Numerical control, in one form or another, was employed on thirteen machines, the one outstanding example being the Ex-Cell-O Model 758 Numera-Trol double - end boring machine. Equipped with a Rheem Mfg Co 4-axis tape-control system, the machine performs single-point boring operations from either end, with infinite center locations and variable bore diameters within the range of the machine. At the completion of each bore, the boring bar is adjusted for the next smaller size hole diameter by tape command before the boring tool is removed.

Accuracy of hole diameter is held within 0.0005 in.; center locations within 0.0002 in. of true position; and boring depth, or table travel stop within ±0.0005 in.

Other new Ex-Cell-O machines included Models 731, 732, 751, and 752 single-ended and double-ended horizontal hydraulic boring machines, and the 411 vertical boring machine, which is capable of turning, boring, facing, grooving, and chamfering.

Rapid production of holes that are round within twenty millionths is the claim of Pope Machinery for its newest machine, the Model 10-6 double-ended horizontal boring machine. It features a dial-type numerical-control system which controls rapid traverse distance, fine feed rate, dwell time, and return with rapid traverse reverse. This information is dialed into precision, adjustable timers. Bore depth stops are located on the centerline of the slides and in line with the hydraulic cylinders to prevent deflection of the boring tools. The machine is also available in a single-head model, with a third head at 90° or other angles, or with four heads at 90° or other angles.

G A Gray's horizontal boring, drilling, and milling machine is numerically controlled through a Norden 2-axis Series 600 control system using standard tape.

One of the big surprises was the Atlantic line of jig borers. The smallest machine, Model 4000, has a 12x 18-in. table and sells for under $5000. Also on exhibit were Model 7000, with a built-in 24-in. rotary table, and the Model 6000, with a Norden 2-axis tape control system.

Automatic tool changing was a feature on both the Lucas table-type horizontal boring, drilling, and milling machine. The Lucas machine is controlled by a Lucas-GE Numra-Tronic tape-control system that controls the motion of the head, table, and saddle; selects feeds and speeds; and controls the automatic tool changing system.

Lucas also showed a floor-type horizontal machine with a Lucas-GE Key-Tronic numerical control system. This machine could be operated manually, under numerical control, or from a multiple control pendant.

Giddings & Lewis showed several of their horizontal boring, drilling, and milling machines. A 3-in. jig boring and milling machine was shown with a G&L Numeripoint numerical-control system; a 5-in. floor-type machine with a Numeripoint system; and a table-type machine capable of taking either a 5 or 6-in. spindle was shown with a Numeripoint system, but could also be controlled through a G&L-GE Numeripath numerical-control system.

Positioning speed and accuracy were the main features of the W B Knight No. 65 numerically controlled jig borer. Controlled by a Sperry positioning system, the machine has a positioning speed of 80 ipm, positioning accuracy of 0.0002 in., and a repeatability of 0.0001 in.

Portage Machine Co showed one of its 3-in. horizontal machines with a Warner & Swasey Tele-Probomat (3-axis) numerical control system.

Planers and shapers are stronger, faster

More rugged construction, improved controls, and the higher cutting speeds that take full advantage of carbide tools are the outstanding development in planing and shaping.

G A Gray's low-priced Flying Scot, for example, was specifically designed for high-speed carbide planing—300 fpm, cutting in both directions. In addition, it has a duplex table arrangement so that a setup can be made on one table while parts are being planed on the other.

Rockford displayed an openside planer equipped with the company's Kopy Kat duplicator for three-dimensional planing. The machine has three speed ranges, and a special feature is that the length of stroke is set by a dial selector on a pendant instead of by setting dogs.

An interesting accessory for planers was on display at the Colonial Broach booth. The Romulus milling spindles can be installed on planers to convert them into planer-millers.

In shapers, both Norton and Nebel's Smith & Mills Div were demonstrating machines with tracer attachments for two-dimensional contours. The Smith & Mills shaper was equipped with an electronic duplicator and the Norton with a hydraulic follower attachment.

The candid camera at the Exposition . . .

Russell Hedden, works manager, West Allis Works, Industries Group, Allis-Chalmers Manufacturing Co, Edgar L McFerren, vice president-sales, Giddings & Lewis Machine Tool Co

Drilling and turning are subjects of discussion when H E Alvey, E W Bailey and Robert D Ellingson of Union Carbide Nuclear Co's plant in Oak Ridge, Tenn, meet John C Hussey, Jr (left), sales manager, The American Tool Works

CHICAGO SHOW REPORT

Improved gaging devices speed product checking

Closer tolerances demanded by design engineers to improve the quality, reliability and service life of defense items, capital equipment and domestic products—ranging from warplanes and missiles to washing machines and fountain pens—have made necessary both the continuing improvement of the machine tools with which these products are manufactured, and the development of improved inspection devices.

Automatic

Fully automatic inspection instruments are of growing importance to many production plants—as was evidenced by the attention paid to such devices in Illinois Tool Works and Sheffield Corp exhibits by visitors to the NMTBA Show.

An outstanding unit in the Sheffield booth, for example, was an automatic inspection and segregating machine which in one continuous operation measures the bore, OD and radial play of up to 1200 assembled ball bearings per hour, and sorts them into three categories. Interchangeable tooling permits quickly setting the machine to check any bearing size within a 10 to 50-mm bore range.

Handling

In this machine, bearings are indexed into and out of the gaging station with a belt conveyor which carries the assemblies between adjustable guide rails. A pneumatic gaging spindle checks the ID of the non-rotating inner ring, while the OD of the rotating outer ring is checked with an Airjet unit. Radial play is measured and computed pneumatically as pressure is applied in one direction against the outer ring.

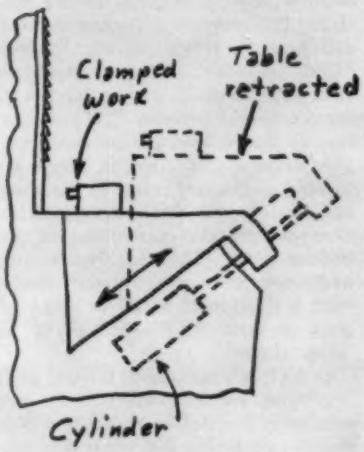
Illinois Tool Works showed for the first time an automatic gear checking machine that makes possible 100% inspection of all teeth on small gears and pinions at rates up to 800 parts per hour. This machine is designed on the "building block" principle, so multiple stations can be assembled to check all the elements of a given gear. The scanning masters used in these machines can be adapted to simple hand rolling fixtures, in combination with electronic limit gage units or recorders, to provide low-cost 100% inspection of small-lot production.

Other new and improved gear inspection devices offered by Illinois Tool Works included a new variable involute profile measuring instrument which incorporates a direct-reading optical device for setting the sine bar, a recently-redesigned helical lead-measuring instrument, a new portable involute profile measuring instrument which can be used to check production gears which are too large or heavy to test on existing measuring machines, and a new, inexpensive production-type gear rolling unit. The portable unit weighs only 25 lb and it can be carried anywhere. This instrument is independent of diametral pitch and can be used to check any involute gear—either spur or helical—from 24 to 200 in. base diameter.

Jones & Lamson introduced a 10-in. optical comparator claimed to be completely universal. A kit, consisting of a base and a tool holder, converts this unit from horizontal to vertical where necessary. Also introduced was a light concentrator that provides a higher intensity of light for optical inspection of parts at greater magnifications.

Broaching

Versatility and productivity mark new broaches. Though broaching machines made up but a small segment of the shows, several new concepts were introduced. American Broach, a division of Sundstrand, presented a building-block broach that can easily be converted from a surface broach to a pull or push broach through arrangement of several interchangeable standard units. It also accepts three types of tables, a straight stationary table, a tilting table, or a 45° sliding table (see sketch).



45° table on American broach allows positive stop and limit switches to be positioned away from coolant and chips. Downward force of broaching tool provides additional tightening of table against positive stop

Working time

Higher productivity is Colonial Broach's aim with its new twin-ram pull-down broach. It eliminates lost time for the return stroke, since loading and unloading can be done while the broach is returning. Two entirely different parts can be broached, or separate operations can be performed on the same part; for example, hole broaching on one ram and surface broaching on the other.

Outside broach

National Broach demonstrated its Red Ring vertical hydraulic broach, which produces gears and other toothed forms by broaching with a tool made in the form of an internal gear.

Shearing and punching

There has been lots of development activity in these machines because of the increased use of sheet metal and plate in prototype, small-lot and mass output of fabricated products. New builders have appeared on the scene, new concepts have been proved out. Existing lines have been greatly improved in accuracy, output, operator convenience, and ability to do far more accurate work.

Most revolutionary bending brake at the Show was the "Form-All" made by Lake Erie Machinery. In this machine the forming blade is set down onto the work, which is then bent up by two rings, one at front and one at back of the bed. Machine makes radius bends, complicated angle bends.

Cincinnati Shaper Co had the biggest brake at the Show—a 750-ton hydraulic machine that forms ¾-in. plate 14 ft long. The automatic cycle makes each stroke identical, may increase production 60%. Machine has possibilities for use with automatic handling and numerical control of punching.

A two-speed control on a Niagara brake relates the dwell to the die setup, controlling advance to the work and then the forming speed. Hold-downs transmit the load into the crown instead of the shaft. Another 2-speed motor controls the back gage, giving fast advance and then slow movement to the exact dimension. A mirror shows the desired shear line.

Wysong & Miles had a high-speed machine for shear lines. A machine for 14 gage x 52 in. width will produce 200 pc per min., and a ½-in. machine is planned to operate at 70 strokes per min.

An adjustment for notching and slitting is featured in a Lodge & Shipley Model 0410 shear that has an air-hydraulic hold-down. This hold-down arrangement and the self-alignment back gage are said to promote accuracy in squareness and parallelism.

For the forge shop, Buffalo Forge has a 400-ton hydraulic bar shear that grips on opposite sides of the work, close to the knife to avoid bending the stock. Hence, the machine can cut alloy bar without causing secondary cracks and can shear in two stub ends down to 1½ times as long as the major diameter.

Two Wiedeman turret punch presses were set up with numerical control to punch hole patterns in sheets up to 30x48x3/16 in. Up to 60 holes per minute are punched to an accuracy of ±0.004 in. of location in either axis. All motions occur within the cycle time of one second. The table moves at 500 ipm. Machines like these are estimated to pay for themselves in one year from labor and setup savings alone, and to yield a further $20,000 saving for templets, and also to eliminate a large work-in-process inventory.

Presses

Standout attractions in new presses at the Exposition fell into three major categories: Die setting has been simplified, controls have been improved, and flexibility is greater. There were several displays of new OBI's, gap-frames, and automatics.

In more than one instance, press builders have provided "automation" for the small shop and jobbing stamper. Niagara, for example, has a wide sliding bolster that, lifted by an air cushion, slides with finger pressure. As applied to an OBI (the worst condition for operation), press utilization reaches 95%, instead of 60%. The press was shown fitted with a wing on each side of the bed for the bolster to ride upon. In only 45 seconds, the die in the press was unclamped, the bolster moved to bring a second die into position, and the punch holder was clamped.

Workhorse presses like OBI's and gap frames have a vast number of improvements. Inclinables now made by Bliss not only have larger-than-normal crankshafts, but improved rigidity that gives a higher degree of parallelism between punch and die.

In its "M" Series presses, Niagara offers models for standard speeds, as well as ultra-high speeds (600 to 1000 spm). Such speeds are possible with a low-inertia aluminum slide and a counterbalanced crankshaft.

OBI's built by Minster have a new lubricant-circulation system, in which a control offsets changes in lubricant viscosity when the temperature in the shop changes. Model B1-22 gap press, which featured speeds as high as 800 spm at a 1½-in. stroke, is built for progressive dies.

Danly, still another OBI press builder, has provided eddy current drive (increasingly applied by several press builders) on a 110-ton OBI press. With this drive, speed can be varied from 30 to 60 spm.

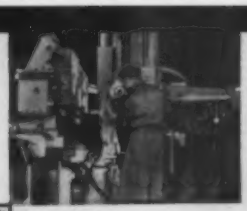
Reduction of wear and maintenance of close slide clearance are reasons why two additional builders —Ferracute and L & J—use Formica inserts instead of bronze to guide their box slides in OBI presses. L & J reports that it also uses a Formica ball seat for the connection and has found no tendency to swedge under impact or to wear in contact with the steel connection member.

New features in automatic presses are intended to minimize stoppages and maintenance. In a 400-ton press built for a foreign auto firm, Danly provides positive feeding, even at strip feeds of 1200 ipm.

Feed-length compensation while the press is running is also featured in the Minster Piece Maker, which runs at up to 400 spm. Normally, a press like this would be considered a blanker, but dynamic balancing and absence of front-to-back motion allows this press to be used for forming as well. An instantaneous stop is supplied for die protection, and die setting is made easy by the

Candid camera . . .

M A Hollengreen (right), president and general manager, Landis Tool Co, talks about crankshafts with Stanley Senior and J A Arnold, senior planning engineers, Vauxhall Motors, England



CHICAGO SHOW REPORT

electric controls provided for ram movement.

Not all concerns agree that a "high speed" press should run at upward of 1000 spm. They point to difficulties in feeding, and say they would prefer to use multiple-station dies in a slower press. Such thinking is typified, perhaps, in air-clutch presses made by L & J, in which speeds of 450 to 550 spm are used for high-speed cutoff and precision jobs that do not involve progressive dies.

By putting the oil chamber on top of its Hydraform machine, the Meta-Dynamics Div of Cincinnati Milling Machine Co has made the machine a high-production deep drawing unit. Production rate is 6 to 7 times greater than on former models. With an automatic feed the high-speed version will produce up to 1200 parts an hour.

A simple finger speed that transports parts by grasping the part surface instead of the scrap skeleton was shown on a wide-bed, straight-side press in the L & J booth. This feed is a product of the Automatic Feed Co (Napoleon, Ohio). Called the Trans Feed, the device is made with a feed stroke of 5 to 12 in. for presses up to 400 tons, and a stroke of 12 to 20 in. for presses with a capacity of more than 400 tons. Reciprocating bars are fitted with fingers that grasp the part at each die hole, advance it one station, and return. Feed does not interfere with a stack or roll feed.

Because the diecaster now wants, for maximum production, a trim press adjacent to each casting machine, Hannifin now builds a 4-column platen press that has a fast operating speed and enough platen area to allow application of side piercing and trimming tools. The trimmed part can be pushed through the bed or lifted by a cushion. A smaller trim press, built like a hydraulic OBI, accepts diesets previously used on mechanical trimming presses.

Accomplishments in press design since the 1955 Machine Tool Show probably rest as much on development and application of new and better controls as on anything else. When you can stand nickels on the upper platen and the bolster, then stop, start, and run the press repeatedly without a single coin quivering, you have a sweet-running piece of machinery.

The eddy-current drive is liked by several builders. Although this drive is said to cost more than an air clutch, one finds them on the high-speed presses and also on those with slower speeds, because the speed can be changed easily while the press is running. Various improvements have been added to the eddy-current drive. One is the use of static controls on the rectifiers, to minimize warm-up time.

There is always a need for precise and easy timing of loaders, unloaders, die lifters and other functions in relation to crankshaft rotation. That is why Danly developed its 360° adjustable-cam limit switch. If the timing is to be advanced from, say, 340° to 10°, the cams that control the function are cranked *ahead* 30°, not back. The exact setting is shown on dials, and the adjustment can be made while the press is running. The operator can always see what he is doing and its effect on the line or tooling.

Modern overload protection has two objectives: (1) the usual concern over possible breakage of a crankshaft and (2) quality control of the work. Niagara has two safety controls that embody these principles. The No. 2 portable control plugs into a strain-gage connection in the press throat and reads the load in percent of the "press factor," as stamped on a plate. The die setter can estimate accurately the true load on the press and the tools. He detects overloads, of course, but he can also set the tools to make the correct hit (and not underform or overform the part) according to records of satisfactory readings in the past. This simple device can be used in any press shop, large or small, to prevent accidents.

The No. 112 load monitor is a panel that shows by lights the percentage of press capacity being used on a job. It will also shut down a press if an overload occurs.

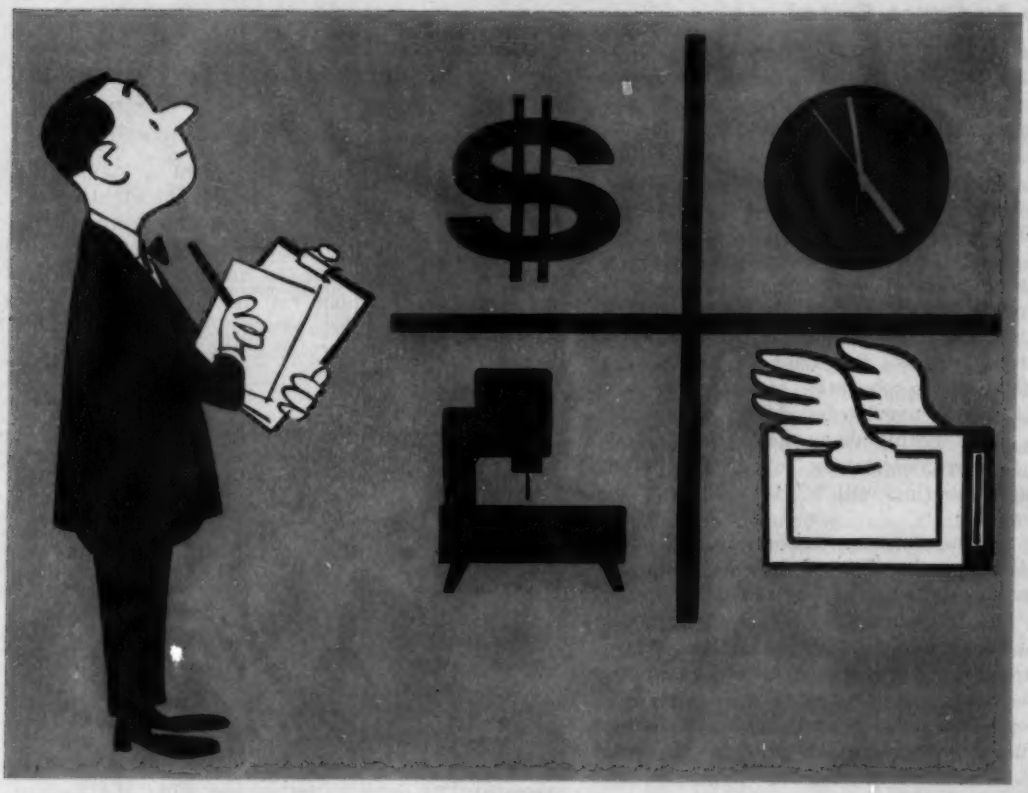
"Metal moving"

Cost-reduction programs in the auto industry are expected to make greater use of cold and hot metal-moving and gathering processes. Information from diverse sources indicates that:

The Intraform machine built by the Meta-Dynamics Div of Cincinnati Milling Machine Co will soon be producing a transaxle component in high production for General Motors' cars. The part is 1.9 in. OD by 10 in. long and has three internal diameters, the central one being splined, that are held concentric within 0.0002 inp. Production of 150 pc/hr is expected. The accuracy, mirror finish and avoidance of machining into flow lines make a part that has excellent wearing properties and costs a fraction of a machined piece.

Within a few months, it is expected that Ford will be using a gigantic thread roller built by Landis Machine Co to produce gears and splined shafts in bar lengths up to 12 ft. long. The pieces would be cut to length from the bars and then finished. Gear and spline tolerances will be held to 0.003 in. for grinding after carburizing. Capacity of this 40-hp, 10-ton machine is said to be 6 in. dia for infeed, with a thread length of 11½ in. and 4 in. dia for bar lengths.

Automatic feeding to its hot header gives a 500% production increase over hand feeding, according to Hill-Acme. Recently the machine has been applied to pole-line hardware. Ability of the process to make strong parts from low-cost steel is expected to be attractive to the auto industry for making torsion bars, drive shafts, and axles at considerable savings.



A guide to Production Control

What is Production Control, and what are its special problems? This detailed report, written by a noted authority on the subject, answers these questions exhaustively. Drawing from his own experience, and from a survey of Production Control setups in more than 500 companies, the author thoroughly explains such subjects as . . .

- **The goals of Production Control**
- **Its relationship to other divisions of the company**
- **Organization of the department**
- **Forecasting and planning techniques**
- **Reports and controls necessary**
- **Inventory-control techniques**
- **Way to control materials and deliveries**

American Machinist / *Metalworking Manufacturing*

Special Report No. 496 • September 19, 1960

By Nyles V Reinfeld, managing director,
National Institute of Management, Cleveland, Ohio

You have Production Control now. But how effective is it? How efficient is it in your own operation?

Every company has some form of Production Control, even if it amounts only to feeding barstock into a machine. In our surveys of Production Control's functions in many companies, we find that there are four discernible stages: the Black Book stage, the Foreman's Assistant stage, the Scheduling Department stage, and the Production Control stage.

Most of these stages are "old hat" in many companies. In fact, almost any large company can point to the existence of *all* four stages, in varying degrees, within its own plant.

The Black Book stage typically occurs in a young

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company that, like Topsy, has just grown. During its early years the founder does the scheduling. As the company gradually grows, he becomes too busy, and he has the foreman take over the job. At this time the foreman does a good job, because he is near the top and can closely coordinate basic scheduling, inventorying, and controlling. In other words, Production Control *is* effective at this point.

But when growth and diversification set in, several foremen take over the direction of the several departments that spring from a once-simple operation. Production Control has now become the prerogative of each foreman, who insists that only the man on the line can do the job. To coordinate his activities—and to relieve his already overburdened mind—he walks through the shop, jotting down notes in his little black book: "Order material for job A605." "Move material into the boring mill." "Have Joe run the Apex job next."

But when several foremen make separate notes, duplication is inevitable. Lathes that are being assembled come out with two sets of tailstocks and no leadscrews. Missing parts are rushed through the shop at great expense, and delays are endless. Excess parts are scrapped, and missing parts turn up months later, mixed with other material.

At this point the foreman scratches his head and comes up with a Parkinson's Law solution: He needs an assistant. Stage Two has begun.

The Foreman's Assistant stage, a continuation of Stage One, is no improvement. Because the assistant works for the foreman, he makes few moves without the foreman's advice. And now that twice as many men handle the scheduling job, things get worse.

The Scheduling Department stage comes when the company decides it needs a formal, separate department, one that can look at the overall picture and integrate the many details into a coherent whole. The department is set up, but conditions improve little.

Here a man in an office builds a schedule. The foremen look at it, lay it aside with a grunt, and continue as before. After all, they reason, what can the office know about scheduling?

Stage Three is thus a period of reorientation, in which management is actively interested in solving the scheduling problem. It recognizes the inherent faults in having many foremen do the scheduling, and it tries to solve the problem by centralizing the Foreman's Assistant stage in the office. In other words, management still accepts the foreman's view that he and he alone can schedule, but it hopes to end the lack of coordination at the shop level by setting up a Grand Foreman's Assistant who helps all foremen.

The attempt fails because the scheduling department lacks coercive power. Management still accepts the foreman as supreme commander of the schedule. Thus we might also call Stage Three "Scheduling but No Control."

Production Control, the fourth stage, comes only when management and the scheduling department work together as a team. Control is achieved by following up a plan. But it really takes more than follow-up, because "follow-up" simply measures the amount of deviation from the plan. Real control comes when the department is able to limit deviation by making it extremely unpleasant to deviate.

What is Production Control?

Production Control has been defined as "having the right material at the right place at the right time." But it is more than that. Material can arrive at the right place and at the right time by accident. But when the operation is planned, and the shop is coerced into following the plan (at first unwillingly, later willingly), then you have Production Control. By this definition, Production Control exists only in Stage Four and in the primitive phases of Stage One—nowhere in between.

Surveys of over 500 companies by the National Institute of Management show that *all* companies have some form of Production Control. Furthermore, we find that some of the oldest companies, and some of the largest, are still operating out of the black book. Most companies, in fact, have several stages of Production Control going on at any one time. The degree of sophistication depends partly upon what problems have arisen in getting out the production. The new company, and the small company, may thus be just as advanced as their older neighbors.

What is the best organization of a Production Control Department? We can best understand this organization if we can state what we want from the department. To do this, let us see what the various divisions of a company expect.

What management wants

Above all else, top management expects Production Control to get the order delivered on time. Customer relations is an extremely important feature of company health. Today's market reduces price as a factor of competition, so that delivery becomes increasingly important. Large firms such as Minneapolis-Honeywell and Westinghouse maintain files on the reliability of their important vendors. Naturally, the vendor who is most dependable with his shipping can expect to pick up the greatest share of the volume.

The problem of producing on time is becoming increasingly complicated. If every company made only one item, there would no difficulty. But the days when you could "buy any color Ford as long it's black" are past. Yearly style changes alone tend to multiply the problem by the number of years in a company's

history. Add to this engineering and design changes, plus a broadened product line, and the problem is no longer simple.

Once Production Control begins giving the desired deliveries, management will begin asserting pressure in other areas. For one thing, management wants Production Control to maintain balanced stocks of inventory. But the question of inventory certainly returns us to the problem of delivery.

Management also wants proper, meaningful reports. When a customer calls, he deserves a factual answer on the progress of his order. One of Production Control's most important functions is to help management keep the customer informed. This rule is important: Deliver the order on time, if possible, but if you can't, keep one step ahead of the customer by telling him of the delay before he calls you. Advance warning may let him rework his own schedule without trouble.

Top management expects low production costs. But cost-cutting, it should be stressed, is secondary to delivering the order on time. The number of rush orders that you accept each week is dramatic testimony to this fact. To illustrate this point further, we should note that management observes delivery of orders almost hourly; cost accounting, on the other hand, occurs some time *after* the order has been shipped. Hence, Production Control answers for its cost mistakes monthly; for its delivery mistakes, it must answer daily.

Finally, Production Control is expected to coordinate the conflicting production demands by other departments. Certainly the Sales Department—and, more specifically, individual salesmen—have a keen interest in the latest orders they are handling. If a semblance of order is to be kept, Production Control must act as a buffer between overzealous salesmen and the shop. Salesmen should not be permitted to by-pass Production Control. They must work through Production Control, *not* be permitted to reschedule shop production to favor their own interests.

Hence coordination becomes an important facet of Production Control. In fact, one very good definition of Production Control is that it is "coordination and cooperation without capitulation."

What Sales expects

One statement expresses the Sales Department's interest in Production Control: Ship everything on time.

It is difficult to distinguish clearly between "selling what we make" and "making what we can sell," because all companies really do both. Obviously, the country's automotive dealers could sell *some* airplanes to the public, but today they would be unsuccessful in getting the automakers to produce them.

Thus every company to a large degree limits its Sales Department to what it considers its proper manufacturing domain. Beyond this, however, progressive firms accept the necessity of producing what they can sell. But the old factory manager (and probably all new factory managers) will never accept this dictum gracefully!

Making what the Sales Department can sell is almost without exception an inefficient way to run a plant. Furthermore, it complicates delivery of orders in two ways: First, it reduces the degree of smoothness by which orders flow through the shop; secondly, it limits the stocking that can be done.

Production Control and Sales can help each other considerably in another area: Getting improved customer relations. The Sales Department can begin by distinguishing between the *truly urgent* order and the order *marked* urgent as a matter of convenience.

The Production Control Department must recognize that Sales needs production information. Sales, for example, can handle orders better if it has two vital bits of information: a report on the plant's current capacity (and what this means to orders and deliveries) and information on practical lead times.

Periodically, Production Control should advise Sales of work loads and of open capacities in certain production areas. Sales thus knows that certain orders can be produced almost immediately.

Too, Production Control must demonstrate to Sales the company's past experience on lead times for a given product. Armed with such facts, the salesman in the field knows that, to shave a given lead time, he will have to coordinate his actions with those of the home office. As a result, he does not quit accepting rush orders, but limits them to urgent matters.

Incidentally, because large inventories are associated with the ability to deliver, Sales tends to favor them.

What the Controller expects

The Controller looks to Production Control for two things: low costs and low inventories. On the matter of inventories, he and Sales are usually in direct opposition. One Production Control manager has noted, in fact, that when *both* Sales and the Controller are dissatisfied over the size of the inventory, then he presumably is doing a good job.

What the factory expects

The shop's interest in Production Control again differs from that of the other departments. The shop wants long runs that will reduce the number of setups. Production men want a balanced work load that will improve their personnel relations, and they want good costs to demonstrate at budget reckoning time. They really care very little (and have little incentive to care) about the schedule. Instead of getting orders out on time, they would rather group orders to save setups.

It is important that we learn to build into factory

attitudes a desire to produce on time. No longer can foremen regard scheduling and loading as their exclusive domain. Each must learn to work through Production Control. Each must learn the value of integrated scheduling.

Few foremen enjoy the change that good Production Control brings to their jobs. Most of them are hostile to the rebuilding of management organization. Don't forget, at one time they *were* Production Control; they still feel that they alone can do the job. Furthermore, they point out, scheduling and loading cannot be done from the office. Only the shop, they assert, can know every condition.

Actually, anything that can be learned can be written down. Anything the foreman knows can be written down for Production Control.

Production Control's toughest trial comes at the hands of the foreman. The Sales Department is always a tough customer to deal with, but with Sales it is possible to put your finger on the source of the problem. With the shop it is different. A strong, unrelenting foreman can wage guerilla warfare against the Production Control Department in such effective ways that the department will be discredited. He can move jobs around indiscriminately, then give a dozen reasons why Production Control's schedule will not work. On the other hand, the foreman who accepts the change can take the same schedule and prove that it is sound.

A typical case history is the experience of a small company that makes metal lawn furniture. The president had started this company. As it grew, he abdicated scheduling to the foreman. Expansion continued, and the black-book problems described earlier developed. At last the president was forced to revamp his Production-Control setup. He hired a man and set up a central Production Control Department. What makes this case interesting is that, although the president personally directed the transition, he could *not* get his foremen to relinquish their hold. In desperation, he finally fired one of his best, but most unrelenting, foremen.

The good Production Control Department learns to work with the shop, to use its knowhow. Many Production Control managers have weekly meetings with shop people. At these get-togethers, they discuss the schedule with foremen and shop schedulers. "Bugs" are ironed out and necessary changes made. The shop then tacitly approves the schedule, leaving the foremen with little excuse for changing it. The benefits to the company are reflected in improved deliveries and lower shop costs.

Organization of the department

From the preceding discussion, we can see that Production Control must have some authority over the shop, and that it must also be able to parry the blows rained down from Sales. How can a department achieve both of these—in proper balance? Our 500-company survey indicates the most common solution:

In small companies, Production Control usually reports to the president or vice president of manufacturing. In larger companies, Production Control reports to the above, or to the works manager, factory manager, or plant superintendent.

Only in a very few companies is Production Control under the direction of the Sales Department. There is probably a very good reason for locating Production Control in the manufacturing wing of industry. Most plants care very little about the customer. But to the Sales Department the customer is king. Putting Production Control under the influence of Sales tends to neglect the interests of the shop and to favor those of the customer. Because Production Control's basic objective is good delivery, placing it under Manufacturing puts stress on delivery, but not to the complete exclusion of the shop's rights.

Obviously, from this discussion you can see that Production Control can be organized any way you wish, if the balance between Shop and Sales can be achieved. If your Sales Department is dominated by your shop (which would indeed be rare!), then you might profitably put Production Control in the Sales Department. But don't put Production Control under the Controller unless he is sales-minded.

I lean toward the idea that someday Production Control will be a branch of management, on the same level as Sales and Manufacturing. This organizational plan will work best when you have a strong Factory Manager, strong Sales Department, and strong Controller.

Internal organization

The internal organization of the department is less important for the small company than the large, because one man tends to wear many hats. The main thing is to get results, and the best results often come from cutting across accepted concepts of organization. Our survey of companies shows that, at present, there is no clearly established pattern for Production Control organization. In other words, the department varies (in what it encompasses as a function) in each company.

Nonetheless, certain basic functions must be thought of as constituting Production Control. These are

shown in the diagram that appears below. Notice that no attempt is made to draw a formal organization chart.

Although the ideal organization chart would include the "Basic Functions" shown in the diagram, few departments are so organized in actual practice. What happens is that Production Control functions are located in several departments. Sales, for example, may do the forecasting and have control over finished inventory. Purchasing may have control over raw materials.

As a result, the real Production Control Department in most companies is reduced to scheduling, dispatching, expediting controls and reports, and controlling in-process inventory.

How much detail is needed?

Many companies associate sophistication in Production Control with the amount of paper being shuffled. This is a mistake. Good Production Control can result from elementary paperwork procedures and is, in fact, independent of the paperwork. The key to good Production Control is in the relationship of the department to its management, to the shop, and to the Sales Department.

Computers, for example, can be a contributing factor to good Production Control, but only if they can process data more economically or more rapidly than hand methods. The computer does not *do* Production Control, but merely assists the scheduler by providing him with data faster.

In recent months, I have encountered two very different types of plants that have found punch-card equipment unadaptable to their Production Control needs. One was a machine-tool plant and the other made ceramics (both firms had about 300 employees). One made a feasibility study, and the other tried for nine months to prove that the equipment would work. Both efforts ended negatively.

We can only conclude from these examples that any firm, before it embarks on the punch-card ocean, should make a careful study. Production Control at best represents a marginal area of application of such equipment. It works well for some but not for others.

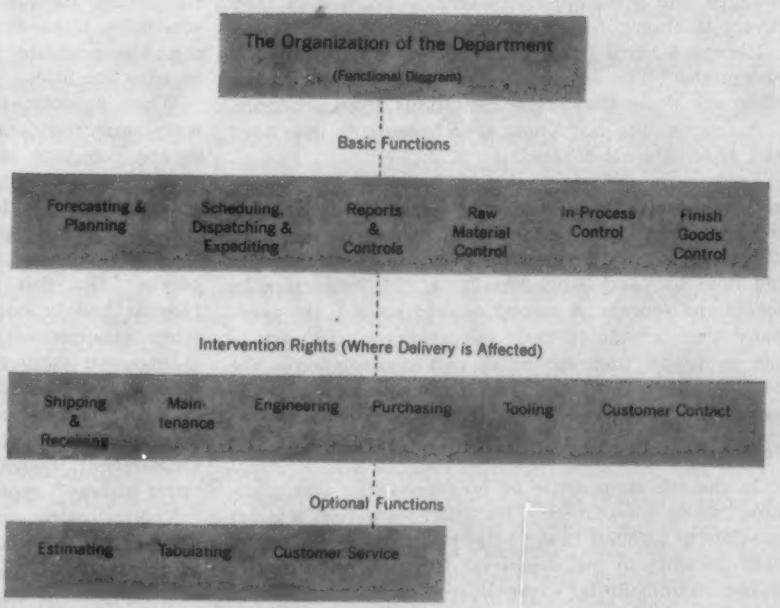
How about paperwork procedures in Production Control? Here again we find wide variations, but I do think we can state certain rules on paperwork.

One rule is *"Do not handle any more paper than you have to."* This is a simple enough rule, but, as Parkinson points out, it is easily violated.

For example, when a problem recurs at intervals in an irritating way, we tend to take steps that will eliminate the recurrence, even if the steps required are out of proportion to the benefits. An excellent case in point is the maintaining of perpetual inventory cards. Most companies keep them, and they can give you the reason: To know what stock they have on the shelves when an order comes in. With this knowledge, they can give quicker answers to their customers. Unfortunately, such answers are not always realistic, considering posting errors.

In one small company with about 125 stock items, maintaining a perpetual inventory record required almost a full-time clerk. At the same time, it was common practice to check the inventory physically once a week—a job that took about two and a half hours. The perpetual record contributed little to the operation, considering the inaccuracies, but did materially increase costs.

Today large firms like Minneapolis-Honeywell, Westinghouse, and General Electric have found it expedient to eliminate perpetual-inventory records on items of low dollar movement. Because these ignored items are about 70-80% of the inventory, the number of records to maintain is sharply reduced. Those items not covered by perpetual-inventory records are maintained in special types of physical storage known as the two-bin system.



Production Control has certain basic functions, as the organization chart to the right shows. Note the distinction made here between "basic functions" and "intervention rights." If any areas listed in the second tier can block delivery, Production Control should have the right to intervene. Otherwise, it cannot effectively fulfill its main objective: to meet delivery dates. This functional diagram, it should be noted, is not a formal organization chart, but shows the areas in which Production Control normally will function under an effective setup

This two-bin system comes in several forms. One technique is to divide the stock into two piles (bins). When pile number one is gone, the item is requisitioned, and the second pile keeps things going until stock is replenished (refilling the two bins). A white mark on a single bin, or a pink sheet inserted between stocks, can in the same way divide the stock into the two-bin concept. If a single stockroom clerk has the responsibility for replenishment, the two-bin system can give very effective controls.

Another way to generate unnecessary work is to use mechanical aids such as visual charts. Such boards may be valuable as visual aids, but they also represent duplication of effort, because anything on a visual representation is also on a piece of paper. Our survey of over 500 companies showed that over 75% of the firms that bought such devices are no longer using them in the way originally planned.

Here is another rule for paperwork procedures: *"Design your own forms."* Experience shows that people work best with what they like, and they like their own creations best. Many consulting failures in Production Control can probably be laid at the doorstep of too many new and confusing forms. People don't understand new forms; they resent the changes, and if the old forms seem to do as well, they revert to them.

Here is a third rule: *"Report and record only the exceptions."* The only really valuable reports to the office are those that show deviations from schedule.

A fourth rule is *"Know which controls you need and eliminate all others."*

Frequently, reports can be omitted week after week and never be missed. One vice president of a small company had each departmental manager gather up all the forms that crossed his desk and state in writing how he used each. Result: a 30% reduction in forms and reports. A second case in point is the company that schedules each operation, in contrast to the company that schedules and controls only the bottlenecks in the plant. The latter company gets the same results—at much less cost.

Forecasting and planning

In the job shop, little or no forecasting and planning can be done directly. By this I mean that it is not possible to forecast usage rates by products. However, it is possible to make general forecasts in terms of dollar volume, dollar expenditures, and the like. From these forecasts materials and equipment needs can be projected. In other types of companies, forecasting by product usage may be possible, but weakened if the available data is not properly applied.

As a general rule, we can say that if history repeats itself, then sales forecasting should be done by Production Control, with the Sales Department looking over its shoulder. Sales Department forecasts tend to ignore the facts of the past and are optimistically unrealistic for production scheduling, as many schedulers will confirm. But where data and usage rates are historically meaningful, they should be used, and Production Control is in the best position to use them.

If you are trying to forecast the sales of special products, such as those made only to government order, then Sales can best appraise the market, because there is really no past history. From such forecasts, however, the Production Control Department can then build its master schedules and production forecasts.

In any kind of forecasting, Sales is involved to some degree. When forecasting fails, the sin is not that Sales has done the predicting, but that it has not made use of historical data that is available. There are numerous examples, in both large and small firms, of this. I will cite only two cases:

Company A made pottery. Its product line hadn't changed since before World War II. Catalog items made up more than 90% of its sales; only a relatively small number of sales were specials. Yet the company produced to customer order, carrying inventories only of over-runs. The company studied its past history and found that it could forecast. It is now carrying standard items in inventory (a warehouse was built) and soon will be shipping all but specials from stock. Result of the change: sharp deliveries and reduced back ordering.

With Company B, the problem was more complex. Here the Sales Department had for two years in a row tried forecasting. Converted into production schedules, these forecasts had proved very misleading. The problem was intensified by limited warehousing facilities.

When forecasted sales failed to materialize, the warehouse could not hold what had been produced, so the company had to seek outside warehousing. And because the plant was isolated in Florida, excess production had to be shipped to a distant warehouse.

An over-riding policy of this company was to control seasonal sales demand by fluctuating hourly employees. But this technique was costly: New employees had to be trained, and production dropped when experienced workers left.

Intensive studies of the company's past shipping records revealed that, *if this history had been consulted,* forecasts of future sales would have been accurate. Instead, forecasts had come from the Sales Department, which preferred the "intuitive" to the "past history" approach.

The following year, the Production Control Department did the forecasting. Weekly production was set at a rate equal to one-fiftieth of the forecast. Then the department analyzed cost to determine the best

rate of production: 1) Should we maintain even inventories and fluctuate the work force? 2) Should we maintain an even work force and vary the amount of production by overtime hours to meet peak demand? 3) Should production rates be stable, and should we thus pay the cost of outside storage when demand slacks off?

By comparing the costs of running the plant each way, the department found that steady production (without overtime but including rental of outside storage space) was the most economical answer.

The new method of forecasting was so accurate that Production Control could forecast within three days the date at which the company's own warehouse would be overloaded (and thus when outside space would be needed). This company is now producing at a steady rate every week, although before 1959 schedules and loads had changed weekly. The change has brought about lower costs and better deliveries.

Employment vs inventory

The latter example above points up another concept that seems to be taking root in American industry. For years politicians, economists, and industrialists have stressed the need for inventory stability. In other words, industry has strived *at all costs* to maintain certain predetermined turnover rates. The result has been a tendency to stabilize the inventory by unstabilizing the work force.

Today, however, laws of economics, the guaranteed annual wage, and our better knowledge of the facts (that is, our knowledge that frequently we can forecast) are tending to invert this past practice. We now recognize the value of a stable labor force and realize that inventories offer the means to that end. In other words, *inventories must rise and fall if labor is to remain stable.*

This concept is new, but it is important. Cleveland's Euclid Road Building Plant, where the change is but three years old, is a prime example of this new economic philosophy.

It is safe to say that most companies today operate on the old philosophy of stable inventory, fluctuating labor. Only a few have marshaled the facts to make a decision. If your company is beset by seasonal demand, you should ask yourself these questions (and seriously try to get the answers):

1. Can we forecast?

2. Can we compare the costs of level employment, planned output, and fluctuating inventories against those of level inventories and unplanned activity?

Fact and fact alone can answer these questions honestly. Only after you have proved to yourself that you cannot forecast will you know that you are doing all that you possibly can. One word of caution: Do not look for perfection in your forecast. Seek only guidance. Your forecasts will improve with age.

The Schulze and Burch Biscuit Company of Chicago (a small plant) is a case in point. About six years ago, forecasts were the prerogative of Sales and the warehouse managers. Each warehouseman determined what he could stock. Each foreman on the bakery lines determined what to produce. At that time, lost sales were close to $1-million a year because of the unfulfilled demand. And, of course, inventories were high.

Shortly afterwards a new department, Production Control, was created. The manager, Mike Valentine, integrated scheduling of the lines under him; he studied the records and set up stock levels for the warehouses.

The results speak highly for Schulze and Burch—and for Mr. Valentine: Costs were reduced during a period of continuing wage increases. Lost sales due to stock-outs were reduced 95%, and inventories were reduced by 70%! Through continuing experience, Mr. Valentine's forecasts have reached a startling accuracy of better than 95%, including the forecasting of sales campaigns and sales of new products. He maintains that his results can be traced largely to proper handling of historical sales data in forecasting. *He uses the past to predict the future.*

If analysis of your past experience is unreliable, you may find some of the newer techniques worthwhile: statistics, probability, correlation, time-series analyses, mathematical programming, and the like. (For detailed information on these, consult sources in the bibliography at the end of this article.)

Planning is essential

From knowledge comes the plan. If we could forecast *exactly* what we are going to sell, we should need little inventory and could plan our steps carefully. But as our ability to forecast diminishes, we must rely more and more on the orders received from customers. Here planning becomes more important.

Because planning and forecasting are so closely allied, we normally associate the two. As a result, the general attitude toward Production Control is that it works best in a production shop and that, conversely, it is of little use in the job shop.

Just as typical is the attitude of one type of manufacturing to another. I have heard job-shop executives say of the mass-production shop: "What a snap they have. All they have to do is produce stuff and store it."

The production-shop executive has also been known to say of the job shop: "I'd trade with them any day. Imagine being able to wait till the customer gives you his order. No inventory headaches. No miscalculations to worry about."

What I'm trying to bring out here is that, no matter what type of plant you are running, you will still find planning problems at the Production Control level. In truth, Production Control works best in the job shop for controlling in-process operations and in-process inventories. It works best in the production shop for controlling finished goods and parts inventories. Planning in the job shop deals principally with scheduling; in the production shop planning is more concerned with inventories.

Both types of plants can make use of master schedules. The job shop may find it impractical to project work loads in terms of individual jobs (as can be done in the production shop), but departments can make up an effective master plan. Here departmental

loads are projected by months, based on total expected work loads for a period (usually one year). From this master schedule, the shop can order materials, set budgets, and plan financial requirements.

Scheduling, dispatching, expediting

Scheduling is the appointment secretary of a job. Scheduling lists the appointments each job is expected to keep as it passes through the shop. In its simplest form, it amounts to a tickler file that points up the main check points. In more detailed form it may be a type of Gantt Chart (popularized as a Gozinto Chart) that shows the feed-in of each assembly, sub-assembly, and so forth, as usual by airframe manufacturers. In other words, it is an explosion chart that shows timing.

Loading is the process of making a schedule accurate. Deciding to produce Operation 5 on December 6 is fine, but what assurance have you that the machine will be available on December 6? Loading enables us to check this availability. It in effect is the equivalent of maintaining a bank balance for your checking account: As each order or job is scheduled, the time it takes on machine A is deducted from the total capacity of A. When the capacity is used up, the bank is empty and no more checks can be written until more money is deposited.

A simple rule of procedure—one that simplifies detail—says that it is necessary to load only the bottleneck departments or equipment. The assumption here is that anything which clears the bottleneck will also clear the other operations. With good loading procedures, the shop can evaluate delivery dates quickly and make meaningful decisions where overloads are known to exist. Without this information, jobs may have to be "farmed out" to alleviate an imaginary overload. As a result, the shop may be starved for work later on, or else it may get indigestion from failure to act on time.

Loading improves delivery, because it makes delivery promises stick. Guesswork is removed.

Dispatching can be done at either the shop or office level. Many small shops let the foreman handle dispatching. In larger shops, more formal procedures usually call for a shop dispatcher who is part of Production Control. Dispatching puts the schedule into operation. It takes the schedule and assigns the right job to the right machine.

Expediting seems to be common to all plants. Only two out of some 500 firms I have talked to feel that they can get by without expediting. Even in these two cases, it is possible that expediting is being done informally, without being recognized as such.

Reports and controls

Control comes from the follow-up process after a plan has been delivered to the shop. The most important controls are those that keep Production Control posted and those that keep Management and Sales informed.

From its load sheets, Production Control can develop shop load reports that the shop can use in hiring, firing, or transferring men. Such reports are invaluable to the shop. Similar backlog reports can be sent to Sales, to report on lead times and overloads in certain departments or machines.

Another important report by Production Control is one that gives the reasons for late production. Such a report tends to pinpoint recurring problems; it frequently suggests methods for improvement. If, for example, this reports shows that tooling is the cause of 14% of all missed deliveries, the shop can take steps to bring the tooling problem under control.

An important report—one from the shop to Production Control—is a report on progress, that is, which orders have been completed at which operations. Either the dispatcher or the foreman prepares this report.

A report that top management should insist on from Production Control is one that compares actual completions on time with promised deliveries. This report, which should be maintained weekly, provides control of both the shop and Production Control. When these delivery reports are kept for each department or shop in a plant, they show how each is doing compared to its neighbors. Their effect is that each department or shop treats the next as a customer, to whom deliveries must be made on time.

Inventory control

There are only two reasons for carrying inventory: to give good delivery and to reduce costs.

17th Century capitalists may have regarded inventories as prestige items, but that vestige of management's dark ages was neatly removed (from all but the hardy) by the "inventory depression" of the early nineteen-twenties. Those companies that survived their inventory gluttony soon adopted a new policy, which could be paraphrased "Inventory is an unholy curse." In other words, you have to carry it, but you never carry any more than necessary.

The pendulum of inventory attitude swung from prestige to curse in a single year. Today, forty years later, the pendulum is nearly as far to the right as it was at the end of the depression. Witness the cries of alarm from newspapers and trade magazines at the first sign that inventories are rising above normal.

Low inventories are draining industrial capital just as surely (but perhaps more slowly) as did the high inventories of the past.

Man in his haste to avoid a repetition of the 20's established a rule that measures the fluctuation of inventory: *the rule of turnover*. If the turnover decreases, naturally your inventory is increasing, and this must not be permitted. Such a rule as this, with its simple proportions, soon becomes beatified. Modern scientific methods of inventory control have long since laid it to rest as an unfounded concept, but it

still reverently lingers in the hallowed halls of industry and politics. How else can we explain the sacrifice of manpower and money, in seasonal firms, at the altar of fixed inventory level? Or the outcries from the press with each rise in investment?

Modern inventory philosophy says that turnover is a by-product of control rather than a goal. *The real goal is economy and delivery.*

Economy is achieved with such tools as economic-lot-quantity formulas, or economic-manufacturing and economic-purchase-quantity formulas. These formulas are an attempt to measure all the cost variables involved in making an order.

A large run produces much inventory with resultant high storage and investment costs. A small run increases set-up and purchasing costs, and decreases or eliminates any discounts available by large-scale purchasing. The formulas balance one cost against another, to arrive at an optimum production run or purchase quantity. They are not 100% accurate, but they do provide yardsticks instead of guesswork.

One of the pioneers in these modern methods was Westinghouse Electric Corp. Here Wilbur F Hoeing and N H King spearheaded the development and spread of these methods, reducing them to simple, workable relationships. These modern techniques have helped reduce Westinghouse's inventory by more than $100-million!

Other companies using these methods include Minneapolis-Honeywell, Thompson Ramo Wooldridge, Standard Oil of Ohio, Shenango China, and Eagle Signal, to name but a few. In other words, both large and small firms have adopted these methods.

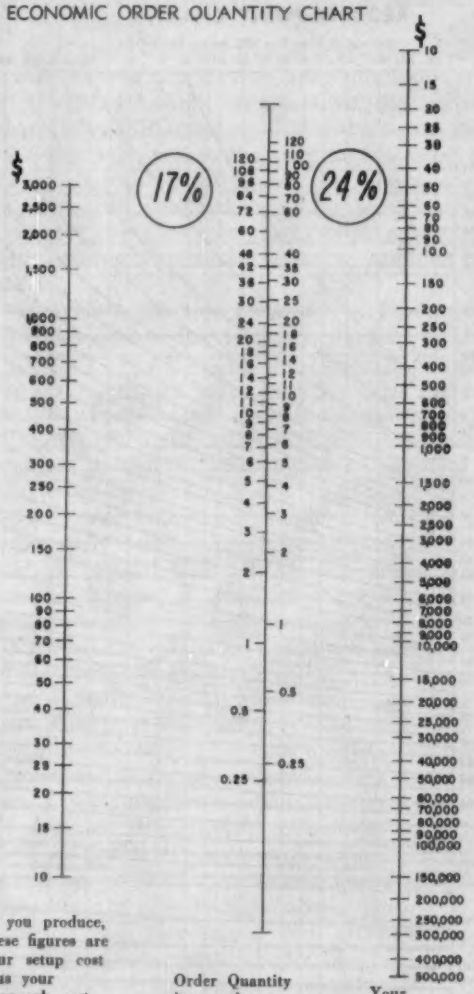
The diversity of products in the above companies is great. At Standard Oil of Ohio, application is to maintenance parts, one of the toughest of all inventories to maintain. At Shenango China these techniques produced results sought by most others: The methods called for such drastic reductions in inventories that the application had to be slowed down to keep the work force intact.

Modern inventory management is not difficult to learn. With the help of easy-to-interpret charts, you can grasp the concepts—and put them to use—quite readily. The following two charts provide quick answers to complicated formulas:

- **Economic-Order-Quantity Chart (right):** This nomogram, entered with your carrying charges and your dollar figures for monthly usage of an inventory item, shows the most economical order quantity of the item to manufacture (or to purchase).
- **Reorder-Point Chart (see p134):** This chart shows the point at which you should reorder an inventory item. Here your usage of the item during lead time, and the percent of time you are willing to accept stockouts, help determine the point in your inventory at which you should reorder.

Man is a great generalizer, especially in this thinking about inventories. Such concepts as those above have been related to a sound set of general principles known as ABC controls. These principles are based on the discovery that a large proportion of inventory

ECONOMIC ORDER QUANTITY CHART



If you produce, these figures are your setup cost plus your papework cost. If you purchase, these figures are your paperwork cost plus supplier's setup cost (from quantity discounts)

Order Quantity in months (% indicated is carrying charge)

Your monthly usage of an item at cost (whether you buy or produce)

To convert chart to your own yearly carrying charge, multiply figures on 24% side of center line by conversion factor, determined by the following formula:

$$\text{Conversion factor} = \sqrt{\frac{24}{\text{Your yearly carrying charge (\%)}}}$$

COMPUTATION OF CARRYING CHARGES

(Yearly Cost Charged Against Value of Inventory)

Interest Rate on Investment ..... _____%

Insurance Rate = $\frac{\text{Insurance Cost} \times 100}{\text{Ave. Inventory (\$)}}$ _____%

Storage Rate = $\frac{\text{All Storage Costs} \times 100}{\text{Ave. Inventory (\$)}}$ _____%

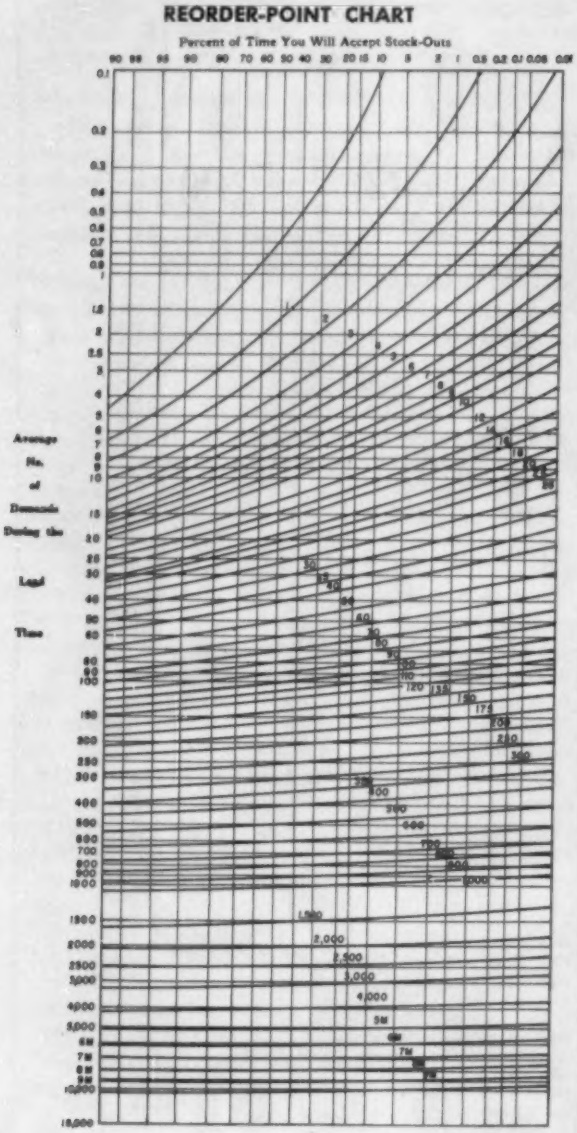
Obsolescence Rate = $\frac{\text{Obsolescence Losses (\$)} \times 100}{\text{Ave. Inventory (\$)}}$ _____%

Deterioration Rate = $\frac{\text{Deterioration Costs} \times 100}{\text{Ave. Inventory (\$)}}$ _____%

Taxes, Miscellaneous ..... _____%

Total Yearly Carrying Charge ..... _____%

REORDER-POINT CHART



TO USE CHART:

1. Select correct usage figure for item to be protected.
2. Select percent of stock-outs you will accept.
3. Find point where 1 and 2 intersect: Read reorder point from curves at intersection.

IF GREATER ACCURACY IS DEMANDED, or where usage during lead time exceeds the chart, the reorder point can also be calculated directly as follows:

1. Determine "Factor" from table below based on percent of time you will accept stock-outs.
2. Take the square-root of the usage during the lead time. (This can be gotten from a table of square-roots.)
3. Multiply square-root of usage by "Factor."
4. Add usage during lead time to product in 3.
5. Answer is the reorder point.

Factors	Acceptable % of Stock-outs	Factors	Acceptable % of Stock-outs
4.0	"Never"	1.29	10.00
2.33	1.00	1.04	15.00
2.06	2.00	0.68	25.00
1.89	3.00	0.39	35.00
1.82	3.50	0.26	40.00
1.76	4.00	0.13	45.00
1.65	5.00	0.00	50.00

items (in a warehouse or purchased) constitute but a small proportion of the dollars tied up in inventory.

Under the ABC concept, the inventory is divided into three classifications, with A items being the fast movers (in terms of dollars) and C items the slowest dollar movers. Special scheduling, purchasing, and inventory controls are applied to each item, depending on its annual usage rate in terms of dollars. Here A items are closely controlled, because they represent many dollars and only a few stock numbers. The much more numerous C items can be loosely controlled, because they constitute a relatively small percentage of dollars tied up in inventory.

Integrated materials management

Not uncommonly, the Purchasing Department controls the raw-materials inventory; work-in-progress inventory is under Production Control; and the Sales Department controls finished-goods inventory. In other companies, finished-goods inventory might be under the controller, or the vice president in charge of tabulating, or the works manager, or Production Control. In other words, there has been little attempt until recently to define the proper organization for controlling inventories.

Because inventories represent investments of millions of dollars, it is difficult to understand this apparent lack of interest. Only a few companies (such as Goodyear Tire & Rubber Co) have for years been treating inventories as a problem of integration.

Recently, the concept of integrating these various types of inventories under one central head has been gaining in popularity. There have been a number of conferences and articles on the subject. The present argument centers around who should control the integrated inventories; answers range from Purchasing to Production Control to the Materials Manager.

Whatever the choice, it is probably less important than the actual accomplishment of the integration. The advantages are closer control of inventories, closer integration between demand and use, and hence lower operating costs with less inventory.

Integrated delivery control

A corollary to, and logical outgrowth of, the concept of integrated material management is integrated delivery control. A well-functioning Production Control Department is operating with its hands tied unless its management has adopted the philosophy of integrated delivery control. Let's see why.

First of all, an order must pass over several key obstacles before it is ready for production: The order must be received from the customer; it must be processed by the paperwork department; it may require engineering, designing, or tooling; it may require tools or other supplementary products; and parts or materials may have to be purchased.

If all these phases are in order, then and only then does Production Control have control over the delivery of an item. And, of course, beyond this realm are maintenance and shipping, which also have their special problems.

In the "functional organization diagram" (p129) I

have tried to introduce the concept of integrated delivery control. In the diagram, you will note the distinction made between *basic functions* (which are clearly part of Production Control) and the *intervention rights* that are listed below these basic functions.

Here is where the concept of integrated delivery control comes into force. What I wish to stress is that Production Control *must* be given the *right to intervene* in all areas listed in the second tier of the diagram, if any of these areas can block delivery. This right to intervene means that Production Control must have the right to step in, set up, and *control* schedules (and hence delivery) of any function in the second tier.

An example of this right to intervene might be in tooling. If tooling fails consistently to get the tools out when needed, Production Control should have the right to intercede and set up a formal set of scheduling controls over the toolroom. This idea may at first seem alien, but in fact it is exactly parallel to Production Control's association with the production shop. Furthermore, it is the only way that a company can expect optimum control of delivery.

In all the areas listed for intervention rights, there is no implication that the Production Control Department take over these functions (if it doesn't already have them), but rather that these areas retain their current status, with the intervention-rights proviso inserted. Back up Production Control under these provisions, and you can expect maximum results.

Questions and answers

Q. Do you need time standards to set up a Production Control Department?

A. No. In fact, one of the best sources for scheduling is a historical estimate, because historical standards frequently are better, from a scheduling viewpoint, than an exact standard. The historical standard reflects actual past performance; an exact standard reflects capability. Hence they serve different purposes.

Q. Should Production Control overload the schedule it releases to the shop?

A. No. This is frequently done, on the argument that an overload tends to put pressure on the shop to meet its time standards. But it is the foreman's responsibility to meet standards—not Production Control's. Overloading the schedule leads to such problems as poor delivery promises and loss of face in the shop.

Q. Is there any way to load a job shop?

A. There is a method called Short Interval Scheduling (SIS), which is also used for maintenance scheduling. SIS releases the schedule in hourly or half-day segments to the shop and to workers. This has the advantage of pacing the shop and avoiding psychological indigestion. On big jobs that are thus released, the work progresses in stages rather than by confusion. It is easier to eat an elephant one bite at a time!

Q. What is the best proportion of Production Control personnel to direct-labor workers?

A. There seems to be no best ratio. In our survey of 500 companies, we asked each for their current proportion. We found that aircraft companies run as high as one Production-Control man to eight direct workers. But in another shop, the ratio may be as low as one per hundred.

The lowest ratio we encountered was one per five hundred. It is interesting to note that the high-proportion companies, such as the aircraft firms, tend to have mechanized procedures; those with low ratios tend to do Production-Control work manually.

Q. What can computers (or punch-card equipment) do for Production Control?

A. Computers can provide data quickly, in ready form. One ideal application is for explosion of materials lists. Another is for sales analysis and inventory control. Accumulations of backlog data (such as hours behind schedule, new work added to schedule over a given period, work hours completed, and the like) are typical uses for computers. Others are engineering-change control, purchase-order control, maintenance-parts lists, manufacturing routing, commitment control, forecasting and manpower control, follow-up reports, order writing, obsolescence and in-process control, and physical inventory.

Only a few companies are using the computer to do machine loading. But for some time data-processing equipment has been used to tally work ahead of a machine. More recent uses are to load work against a series of operations, checking each for availability, and loading each as the availability is confirmed.

Q. Do computers pay their way?

A. From an economic viewpoint, the answer is probably no. Few if any installations of computers in the Production Control area can show a reduction in personnel requirements. Rather, their value is to be measured in terms of accessibility of data.

Q. Who determines the promise date on an order?

A. Three people—the customer, Sales, and Production Control. (The competitor is of course also involved here.) The customer says when he wants it, Sales promises to try to deliver, and Production Control checks the facts to see if it can be done. Actually, no firm promise (except on standard items with known delivery times) can be given until Production Control has checked its records. Then, of course, the president should be required to okay large disruptions in operating procedure, if Sales has asked for these disruptions.

Q. Should Production Control contact the customer?

A. In some firms customer service is a part of the Production Control Department. However, most companies prefer not to have Production Control in contact with the customer, possibly because Production Control generally is not sales-minded. The advantage is that Production Control can give much more meaningful answers, more quickly, to the calling customer, because it can answer production questions.

Q. Should Production Control contact the vendor?

A. The answer here can be more specific than in the preceding question. There are two reasons for having Production Control contact the vendor: First, final delivery is the responsibility of Production Control; secondly, Production Control knows more about the exact timing of production than Purchasing. Thus, by careful planning and close liaison with the vendor, it can have the high-dollar items shipped in to arrive exactly when needed. By controlling the receiving dates on the high-dollar items, it is possible to reduce purchased-goods inventories as much as 50%! Is it any wonder, then, that leading firms which stress close control of inventory have Production Control contact the vendor?

Q. Who is responsible for obsolete parts in inventory?

A. Standard practice is to charge the Sales Department, where it has been overly optimistic in its forecasts of demand; the Engineering Department, where it has introduced improvements without adequate notice to Production Control (necessary improvements, of course, must be made without notice and thus are not charged to Engineering unless they result from an oversight); and to charge Production and Inventory Control for the balance. (Note: In calculating obsolescence rates on inventory, however, one should use the total obsolescence. Because a budget is usually set up for obsolescence in inventory, obsolescence should be expected and accepted.)

Q. What are some typical obsolescence policies?

A. Strangely enough, there don't seem to be any. Some companies, which allow for obsolescence in their carrying charges, none-the-less refuse to scrap the items. They write such items off the books and remove them from standard storage space, but they continue to reserve valuable space for them.

A few companies take a lion-hearted attitude and literally scrap the obsolete items after a history of, say, three years of non-usage. If you relocate your plant, you will find that moving is one of the most effective methods known to man for getting an obsolescence decision. Moving has the effect of cleaning up the plant and warehouse. Why can't this be done as a formal policy—even if you don't move?

There is no common answer even to the question of who makes the decision to scrap obsolete items. Some companies let the inventory manager or sales manager (or whoever is the logical father of the inventoried item) make the decision. Others require an act of Congress. Only a few have a formal policy that establishes authority to dispose as a function of the items' dollar values.

Q. Can you control engineering changes?

A. To some degree, yes. One of the most effective methods I know of for reducing or minimizing changes resulting from carelessness or overzealousness, was done by one firm, which paid the engineering department a bonus that became smaller with each engineering change.

Q. In what ways has Operations Research been used for Production Control?

A. There are several basic OR tools that have been applied to Production Control. One of these is Mathematical Programming, which schedules or allocates work to machines. Reduced to simple charts, the method can be employed by personnel with little or no mathematical training. Results have often been excellent. Mathematical Programming has also been used in trim or stock slitting, product-line analyses, and profit studies. The methods of inventory management, already mentioned, are sometimes listed as part of the OR field.

Probability and statistical studies perhaps are the most diversified and widely usable techniques. These studies include forecasting techniques, sampling procedures like work sampling and quality control, waiting-line and Monte Carlo methods, and what is referred to as Decision Theory. All these methods are being used more and more extensively in industry. Separated from the heavy theory that underlies them, they should be kept under scrutiny by any firm that can possibly use them.

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With a few specially built fixtures, Boeing has transformed alignment of long-bed machine ways from the dark ages of the troublesome taut wire to the modern technique of precise optical measurement

Special telescope and target positioning fixtures improve accuracy of spar-mill alignment inspections, and minimize the time needed. These optical inspections are normally done during third shift when there is little vibration from trucking

Lick that long alignment problem!

By H H Farrar, chief maintenance inspector, and
L L Vorhies, supervisor, Maintenance Inspection Department
Wichita Division, Boeing Airplane Company

Special fixtures devised by Boeing-Wichita tool designers have greatly simplified the optical alignment of carriage-support ways on 75- and 105-ft-long gantry-type wing skin millers and profilers. At the same time, measurements with these fixtures are more accurate than before, and the machines do not need releveling nearly so often.

With the special clamps and target (see Fig 3) three men can check the ways of a 105-ft spar mill in less than three hours—a fraction of the time needed with conventional, taut-wire methods. And machine ways, checked at three-foot intervals, are held straight and level within 0.005 in. from end to end.

The 27 machines on which these measurements have been made were formerly inspected every 90 days (for machines used in roughing operations) or every 45 days (for those on which close dimensional tolerances must be held). Recently, because the machines have kept such good alignment, we have increased the inspection frequency to 6 and 8 months, respectively. Furthermore, not one of these machines has required releveling in nearly two years.

The Onsrud spar mills at Boeing (both 102- and 105-ft models) machine upper wing panels for B-52 bombers, which have very close dimensional tolerances. These required tolerances cannot be held unless the ways on milling and profiling machines are leveled and aligned within close limits.

Checking ways on Onsrud mills

Each of the Onsrud machines has two ways: A 9-in.-wide primary carriage-support runs along one side of the bed, and—spaced 6 feet away along the other side of the bed—there is a 4-in.-wide secondary way (see Fig 2). We have found that the best way to check both horizontal and vertical alignment of ways on these mills is to follow a three-step procedure which takes advantage of our special fixtures. Also, as we will point out a little later, this method gives a check on primary and secondary ways at the same time:

• **First, check to see if the opposite ends of the primary way are level.** To do this, set up a precision optical level (we use a Wild N-III) on an adjustable floorstand to one side of the machine at about its midpoint (as indicated in Fig 2). Then, mount a white-faced optical scale vertically in a holder clamped to the instrument support assembly (circled in Fig 2 and shown in detail in Fig 3) at each end of the primary way. To check the level, simply read the two scales by swinging the optical level between them.

• **Next, establish a line-of-sight between the two ends of the machine.** This is done by setting up the alignment telescope (we selected a Farrand, because it is accurate at distances from 4—80 feet) in an adjustable mounting bracket on the instrument support fixture at one end of the primary way, and an illuminated line-of-sight target in a spherical mount on the support at the other end of the machine (as in Fig 2). Then traverse the gantry carriage until the side of the carriage which faces the telescope is close to the center of the bed—over a bed leveling screw—and shut down the machine. Now, accurately align the telescope with the lighted end target.

• **Finally, check the alignment of machine ways with the line-of-sight.** Still using the same setup as above, place the portable target mount (boxed in Fig 2 and shown in detail in Fig 3) on the primary carriage way directly over the bed leveling screw which is immediately in front of the gantry carriage. Sighting through the telescope, check the

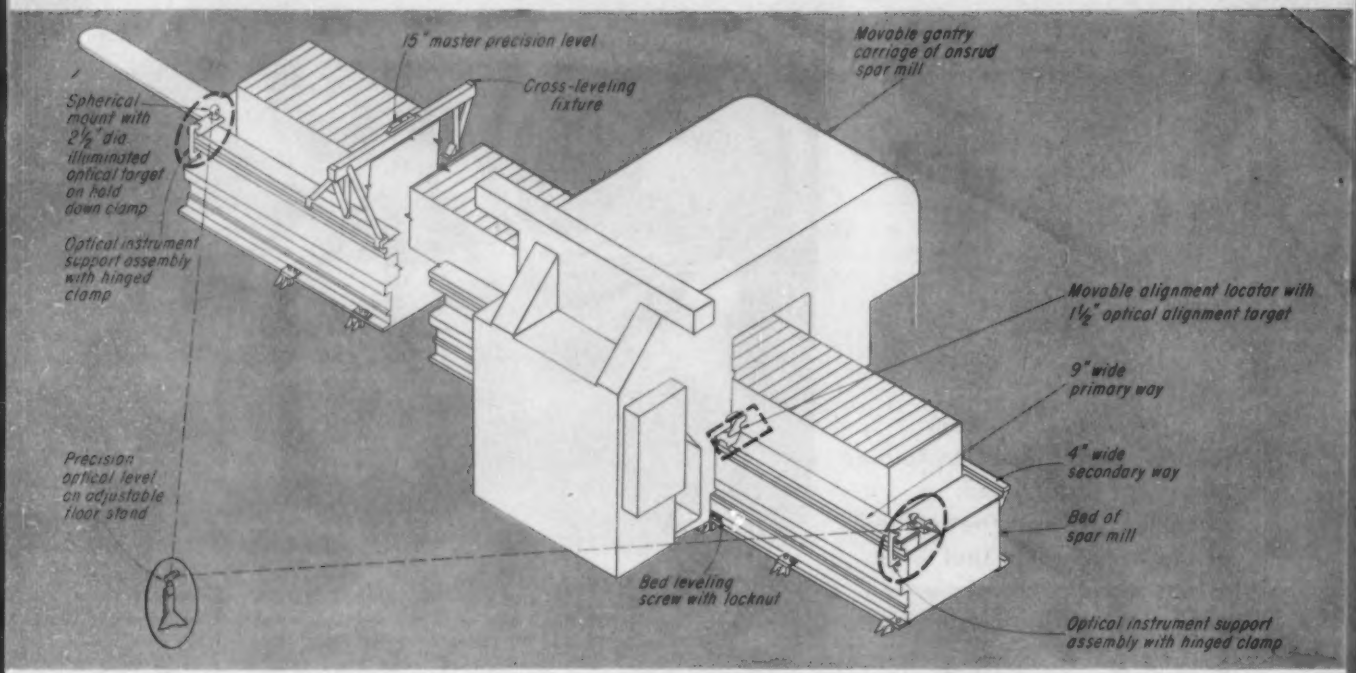

15" master precision level
Movable gantry carriage of onsrud spar mill
Cross-leveling fixture
Spherical mount with 2½" dia illuminated optical target on hold down clamp
Optical instrument support assembly with hinged clamp
Movable alignment locator with 1½" optical alignment target
9" wide primary way
4" wide secondary way
Bed of spar mill
Precision optical level on adjustable floor stand
Bed leveling screw with locknut
Optical instrument support assembly with hinged clamp

Figure 2—With Gantry carriage located approximately at the center of the machine bed, Wild precision optical level is sighted on white-faced optical scales held vertically on fixtures at each end of carriage way to determine if bed is level, end-to-end. Support fixtures (circled) and portable alignment target (boxed) are also used for way alignment checks (for details of these fixtures, see Fig 3). Cross-level fixture is used for horizontal alignment of secondary ways

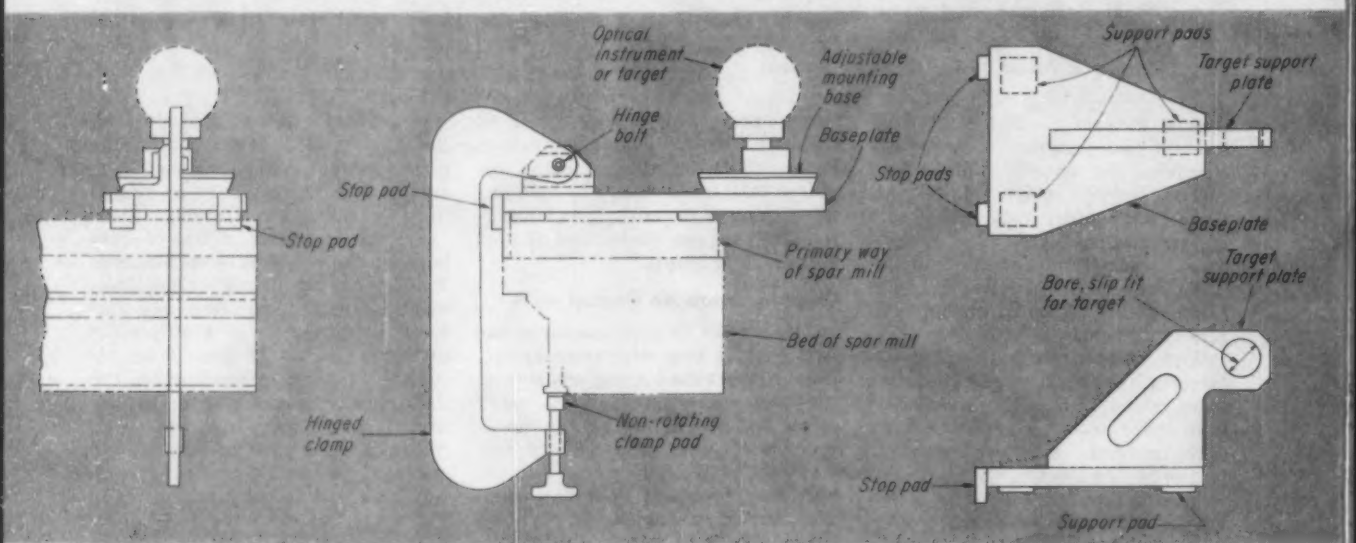


Figure 3—Welded-steel instrument support assemblies (left) were designed to be mounted at opposite ends of the primary carriage-support way of Onsrud spar mills. They have precision support and stop pads to align the support baseplates with the top and side faces of the way, and hinged clamps to hold them in position. The portable target mount of welded-steel construction (right) was developed with right-angle precision bearing surfaces (support and stop pads) that will insure accurate vertical and horizontal location of a 1½-in. diameter optical target—central with the line-of-sight between telescope and illuminated end target—when the way, at the point being checked, is in the same plane as the ends

coincidence of the crosshairs in this portable target with the line-of-sight previously established. Any misalignment of these crosshairs—vertically or horizontally—is measured with the micrometers on the alignment telescope and recorded as an out-of-alignment condition.

To get readings for the other positions, move the portable target to the next inspection station above a leveling screw—advancing toward the telescope—and traverse the machine's gantry carriage close to the inspection position. This keeps the carriage weight near the point to be checked. Now, remove the target and recheck the alignment of the telescope with the lighted target at the other end of the machines; readjustment may be necessary to reestablish the line-of-sight. Finally, reposition the movable target and check its position, as before.

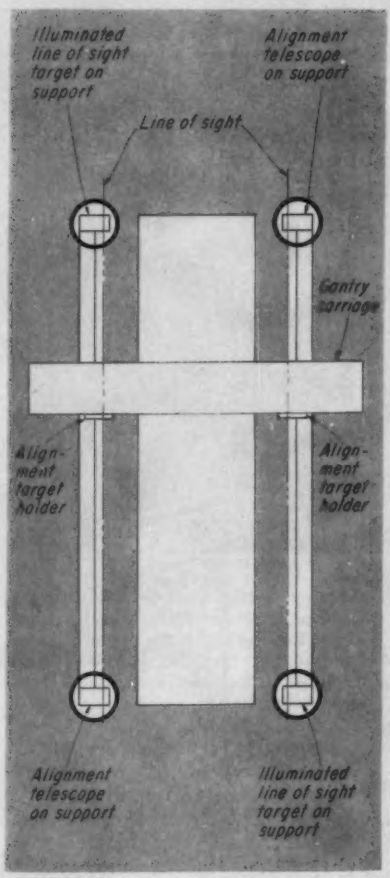

Illuminated line of sight target on support
Alignment telescope on support
Line of sight
Gantry carriage
Alignment target holder
Alignment target holder
Alignment telescope on support
Illuminated line of sight target on support

Figure 4—Duplicate optical setups on each side of a 12 x 80-ft K&T skin mill help cut the time required to inspect ways of these gantry-type machines

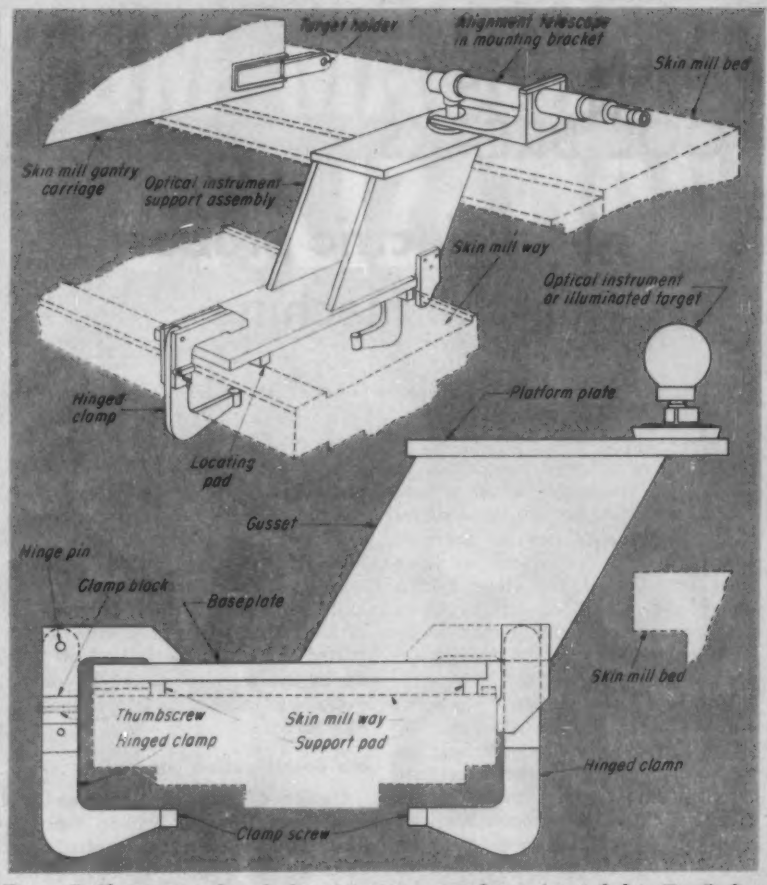


Figure 5—Clamps at each end of instrument support fixture (as circled in Fig 4)—for checking alignment of the ways on K&T skin mills—hold support pads down against thin stainless strips on top of the ways. Fixtures are designed to support optical devices well inside machine so unobstructed line-of-sight can be established

These steps are repeated for each leveling position along the machine.

After this, the telescope and end target are interchanged on fixtures at opposite ends of the bed, the gantry carriage is returned to the initial leveling station, the movable target is placed in front of the carriage—facing the telescope—and a new series of checks are made, as before, working toward the other end of the machine bed. This reversal of telescope positions is necessary only on long-bed machines which have more than 80 ft between the telescope and alignment target.

Aligning secondary ways

Horizontal alignment of the secondary way (on the other side of the machine bed) is easily done right along with the primary. The procedure is simple, and is done with another special fixture (which can be seen in Fig 2). This cross-level fixture is just a 15-in. Starrett master precision level mounted across the bed, eliminating a second leveling.

With the master level on the carriage cross rail, we take misalignment readings — at each checking station along the bed — in terms of angular displacement of the bubble in the level. These are easily translated into actual vertical misalignment values with trigonometry: We have the angle of carriage tilt and the distance between machine ways.

Lining up K&T skin mills

When aligning three magnetic-tape-controlled Kearney & Trecker skin mills which are installed in the wing skin machining area, we encountered a different set of problems. The 18½-in.-wide ways of these machines are spaced 12 ft apart (Fig 4) and are covered with thin stainless steel strips held on the ways with end-to-end tension and have hold-down strips along the edges. After being used for some time, these strips tend to rise up from the ways, making it very difficult to check the alignment.

The optical checking tools developed to overcome this difficulty (see Fig 5) are similar in principle to those developed for checking long spar mills, and have a clamping system which forces the stainless steel strips tight against the top faces of the ways when they are positioned for alignment measurements.

Because the ways of the K&T skin mills are spaced so far apart, we use two telescope and end target systems (circled in Fig 4)—each pair setting up an optical line-of-sight along one of the two ways. In addition, instead of having movable target support fixtures, target support brackets are mounted on each leg of the gantry carriage.

With this arrangement, alignment procedures are basically the same as those used for checking the long spar mills (described above), except that we take all measurements (along each way) from one end of the machine because the skin mills are less than 80 feet long.

With the duplex telescope setup, as in Fig 4, five inspectors easily can check the alignment of one of the 80-ft-long K&T skin mills in three hours or less.

WHEN THE TOOL BREAKS . . .

photoelectric probes stop the machine

By Allan D Gunderson, chief engineer, George Gorton Machine Co, Racine, Wis

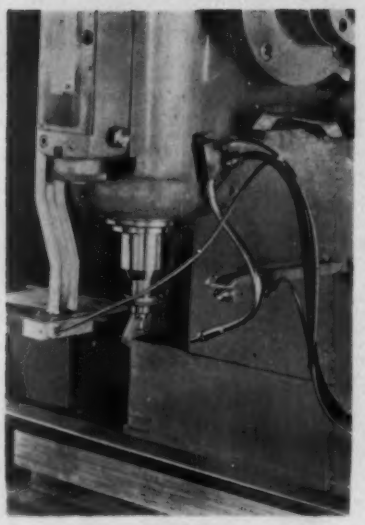
Electronic watchdogs — miniature photo cells that tell when a tool breaks on a transfer machine or on other large units where operator surveillance is infrequent — have been given the acid test (four months under shock-load conditions on a heavy-duty production machine) and have proved superior to mechanical probes.

That is the contention of researchers at George Gorton Machine Co, who set up various probe designs for use on two inline transfer machines recently shipped to Olin-Mathieson Chemical Corp's Winchester Western Division. The inlines will machine forged steel receivers for the Army's new lightweight rifle.

Gorton researchers found that the photoelectric cells, sealed in glass envelopes for complete protection against cutting fluids and/or high-humidity cutting conditions, are more compact, less hazardous and more foolproof than mechanical probes which, they say, can be actuated by chips permitted to pile up in the work area and in almost every instance can be arranged to fail safe.

No amplification needed

Unlike pickup coils, which are sometimes used as broken tool indicators, photoelectric control circuits do not require electronic amplification of signals.



Rotating cutting tools or tool shanks as small as 0.080 in. diameter can be monitored for breakage with photo cells and light sources used in Gorton transfer machines to stop the line and signal operator when tool breakage occurs

In selecting a broken tool indicator for its two inline transfer machines, Gorton chose an arrangemen of Clairex photo cells (photo, top right) and light sources. The cells are particularly important at those machine stations using small-diameter drills and small-shank milling cutters that break easily. Indicators at these stations help keep the machines running as many hours a day as possible, and they prevent scrapped parts by tool breaks.

How it works

The control circuit chosen is an on-off arrangement that either sees light from the source, or it doesn't. In other words, if a tool breaks it no longer is between the light source and the photo cells. Operation of the photo cell does not depend upon the color or the intensity of the actuating light. Light source is a General Electric 6-volt No. 51 bulb, which is used at 5.8 volts. (This increases the bulb's rated 5000-hours about three times.)

Triggering the control

During the Gorton tests, various ambient intensities were tried, to determine their effect on triggering the control cell, thus causing the machine to stop. The control was triggered only when a 25-watt light bulb was positioned approximately 6 feet from the photo cell, about 15 degrees from the axis between photo cell and light source.

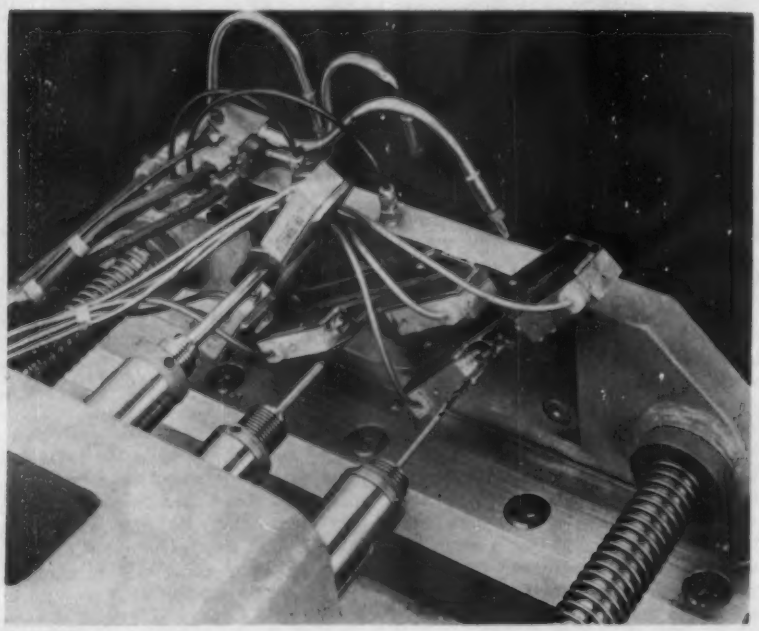
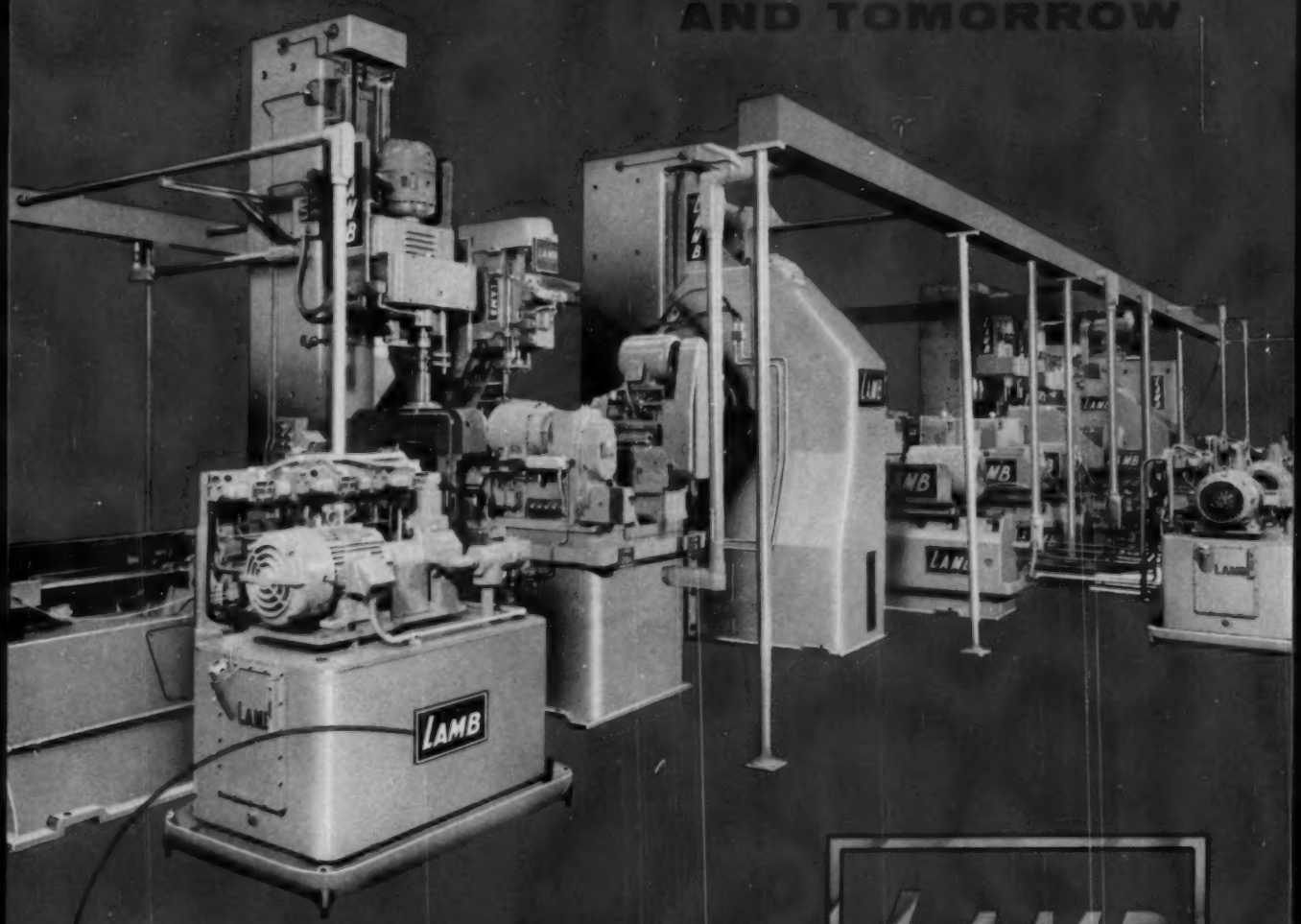


Photo cells and light source pairs are so compact they can be mounted on machine heads equipped with several spindles. Because the cells are sealed in glass, they do not require shielding from cutting fluids—and machine vibration and shock loads do not affect operation

MAXIMUM MACHINE UTILIZATION

FOR TODAY...
AND TOMORROW



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of all Transfer Machines
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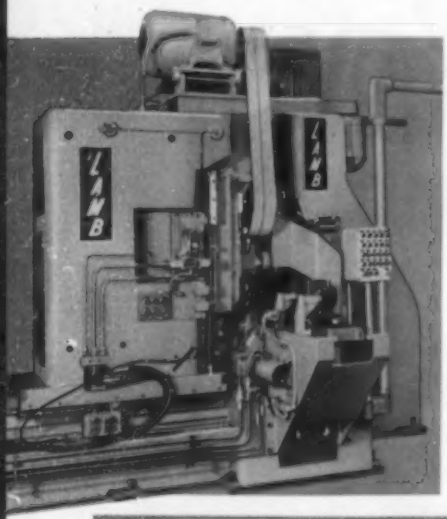
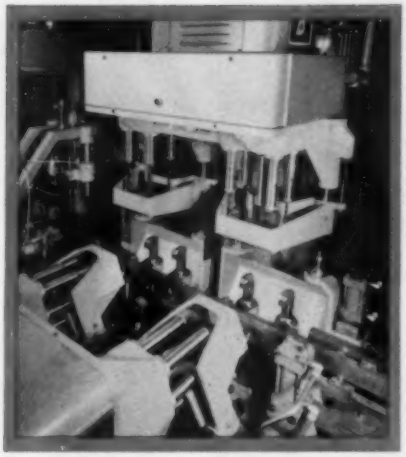
A Few Typical Examples of LAMB'S Maximum Machine Utilization Feature



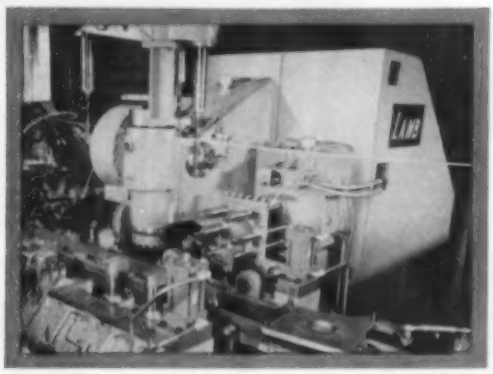
Adjustable Compound Milling Slide

This milling station, although part of the transfer machine, is in itself a standard self-contained milling machine. It can be used to perform a wide variety of milling operations simply by adjusting the controls. In this arrangement the horizontal slide is used for rapid approach and return. The vertical slide feeds the milling cutter across the workpiece.



Single-Slide Double-Station

Here is an outstanding illustration of Maximum Machine Utilization. The vertical and horizontal double-heads perform operations at two stations simultaneously. Each is carried on its own slide and has its own bushing plate. Note the multiplicity of operations performed simultaneously.



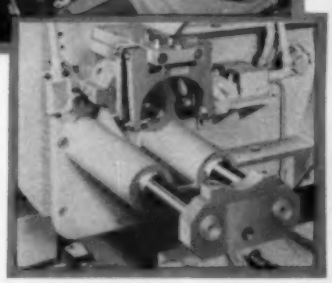
Combination Slide–Milling and Tapping

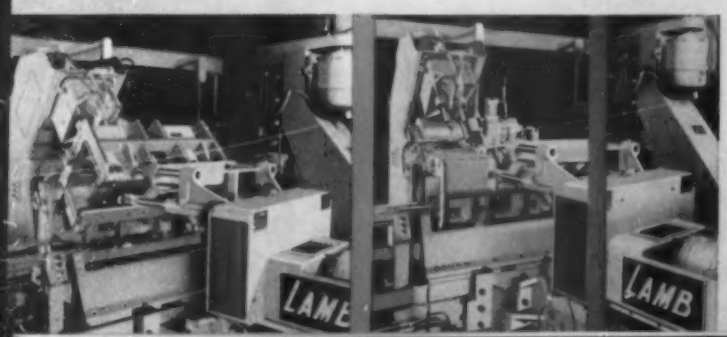
This 2-station, single slide provides two individual feed rates—one for milling, one for tapping. Approach, feed and retract movements of the milling cutter are controlled by the hydraulic power slide while the tapping tools are controlled by a lead screw sliding plate.

Large Hole Threading With Collapsible Dies

To minimize cycle time, collapsible dies are used to produce internal threads in opposing 4⅛" diameter holes. The dies are reset automatically. Although this is not a new method of chasing threads in large holes, the dependable, repeatable accuracy built into this operation by Lamb, greatly increased the overall efficiency of the machine.

Closeup photo at lower right shows the study guide bars and support saddle that aid in removing the heavy die assembly when chaser sharpening is necessary.





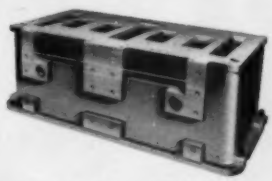
Tilting Fixture Utilized To Eliminate Extra Work Station

To gain access to the bottom flange of the part for drilling angular oil holes, a tilting fixture station is used. Through simple redesign of the fixture and mounting a tapping head at a compatible angle, Lamb eliminated an extra work station saving the cost of an additional main base, fixture and extension of the transfer mechanism.

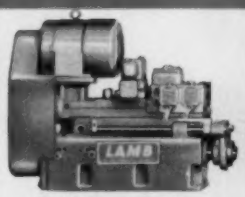
MAXIMUM MACHINE UTILIZATION EXTENDS TO FUTURE PRODUCTION

Include your present Lamb transfer machines in your future production plans. Retooling for new models or part design changes requires little more than new fixtures to suit the new part plus rearrangement of Lamb standard "Building Block" machine components.

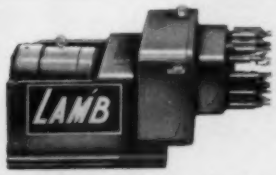
These standard components meet industry's demand for versatility and flexibility in processing equipment. Shown below are several Lamb "Building Blocks" used in the differential carrier transfer machine.



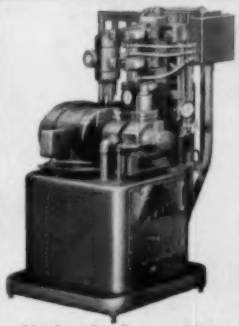
Double Wing Main Base



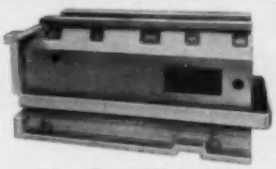
Quill Type Drilling Unit—Hydraulic



Way Type Drilling Unit

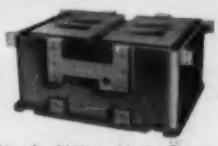


Hydraulic Power Unit



Way Type Wing Base 18" Travel

Way Type Wing Base 24" Travel



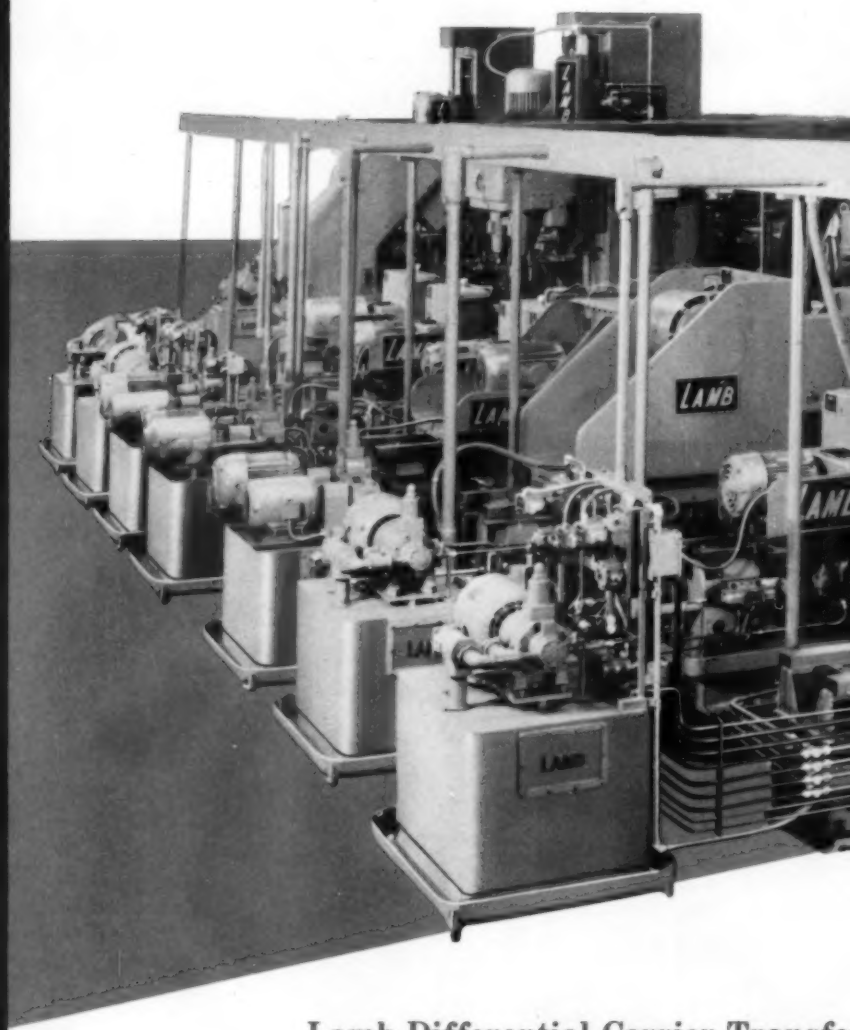
Single Wing Main Base

Vertical Column

. Designed for Present a

High Prod

Another example of Lamb's thorough understanding of modern manufacturing methods and ability to provide efficient, high production machine tools to do the job is illustrated and described on these pages. The design features of this transfe conscious appr at hand as well economy inclu changeover.



Lamb Differential Carrier Transfe

This 34-station in-line transfer machine accommodates two different parts. In the analysis of the parts and the operations to be performed, it was determined that the differential carriers were particularly suited to the 2-station, single-slide machine design. The result is a more compact machine requiring fewer components and represents an overall savings in initial cost, floor space and service maintenance.

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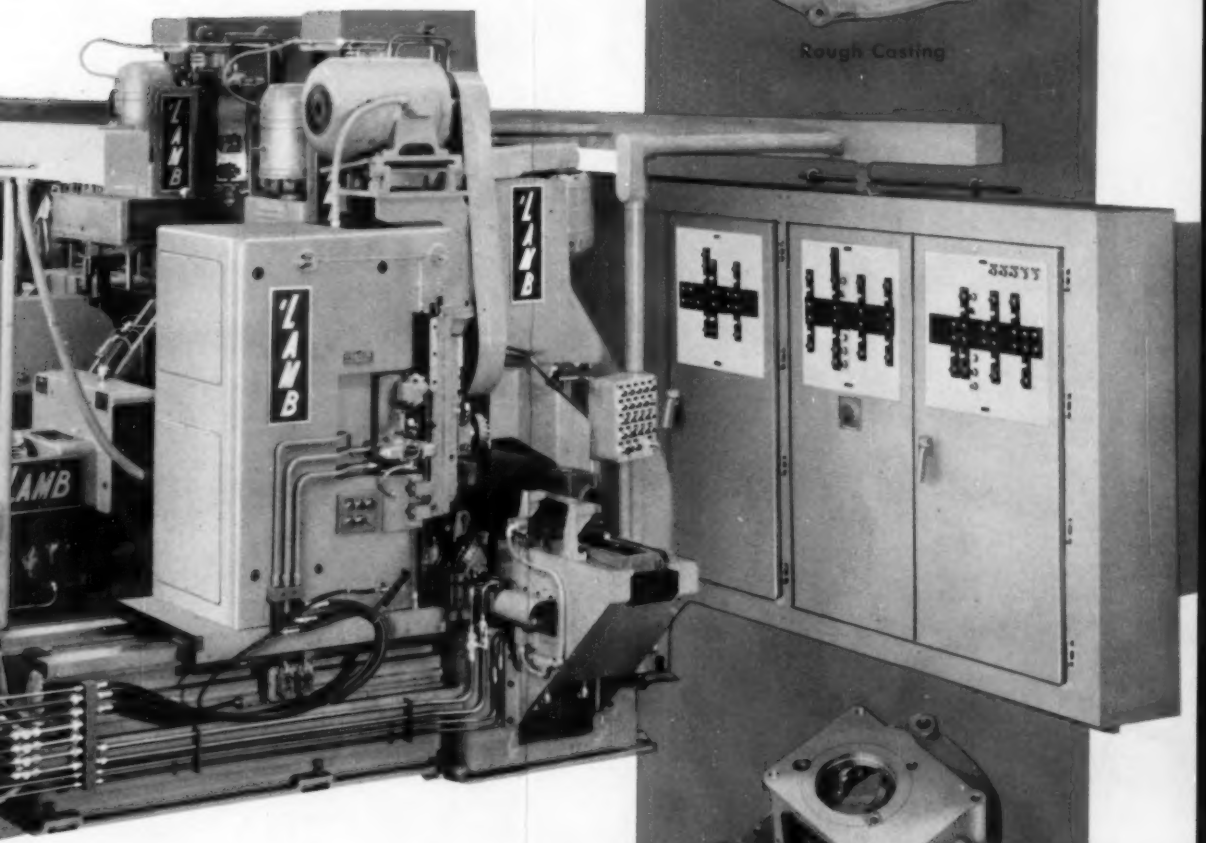

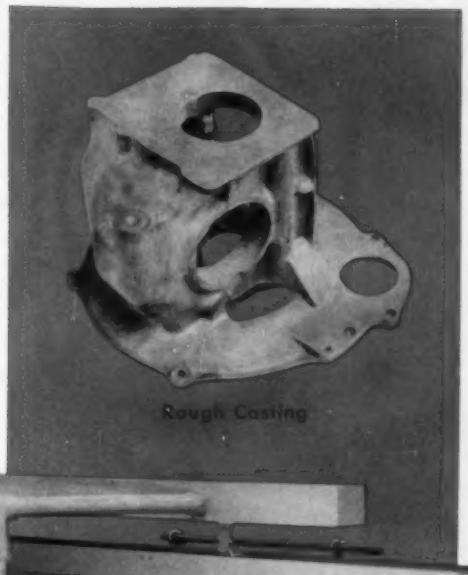

nsfer Machine

are 72 machining operations which
drill (28), tap (17), chamfer (13), bore
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duces 128 pcs./hr. at 100% efficiency.
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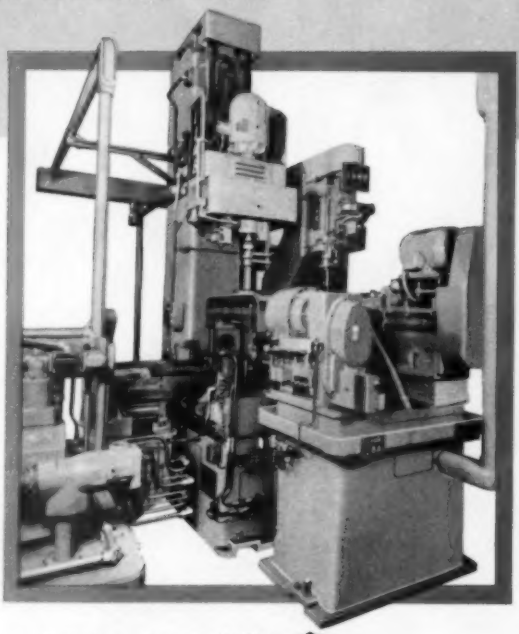
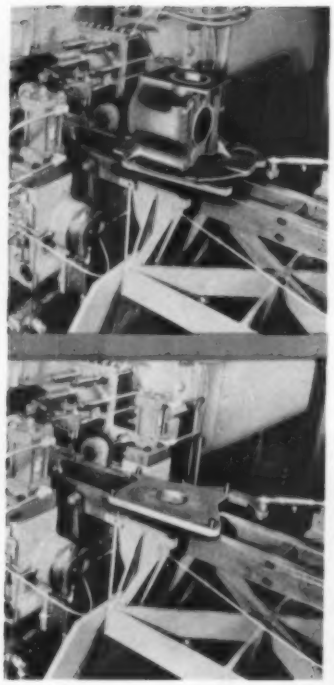
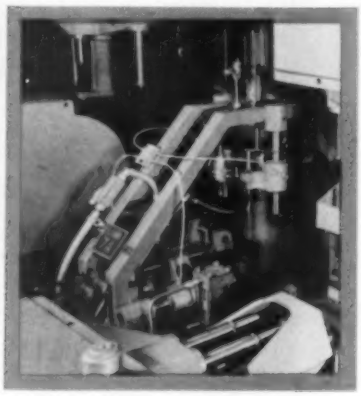




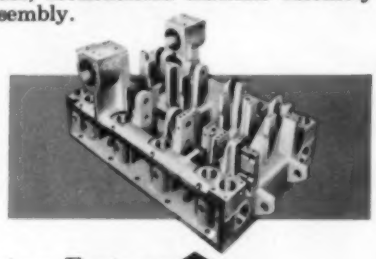
Simple Linkage Repositions Part

A plate, swivel mounted on the transfer bars, carries the part. As the transfer bars move forward the ball type toggle linkage turns the plate and part 90 degrees. Lowering of the walking beam transfer bars places the part on locator buttons in position for the next operation. The plate and linkage are maintenance free. Only occasional greasing of the ball joints is required.



Service Accessibility

Lamb's open-machine design permits easy access to fixtures, tools and all components that require periodic attention. Convenient location and manifold mounting of hydraulic assemblies minimizes downtime. Pipe fittings are grouped for fast, sectionalized machine assembly and disassembly.

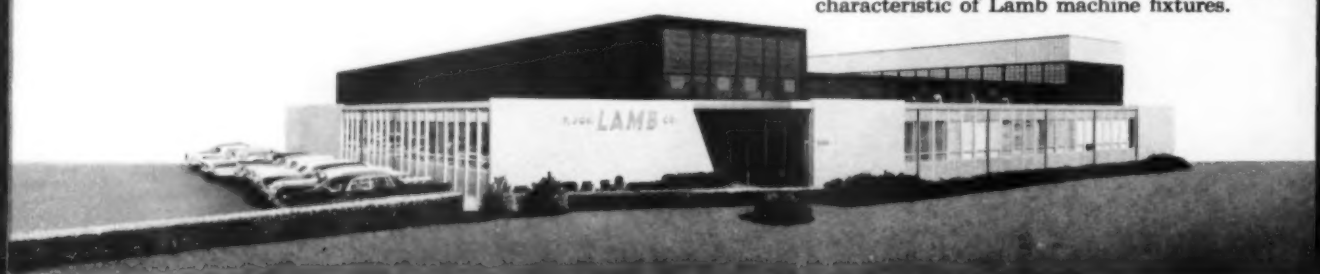


Probes Replaced In Seconds

Horizontal and vertical probes are held in their bushings against a spacer plate by a light spring-loaded bar. Only one limit switch is required with this arrangement which permits single or multiple hole probing. Simplicity of design and ease of maintenance are features of Lamb machines.

Fixture Features

Lamb fixtures are heavy, rigid castings with integral chip sheds. They are precision machined and assembled with quality components that assure accuracy and long, dependable service life. Simple assembly features for EASE OF SERVICE is an important characteristic of Lamb machine fixtures.



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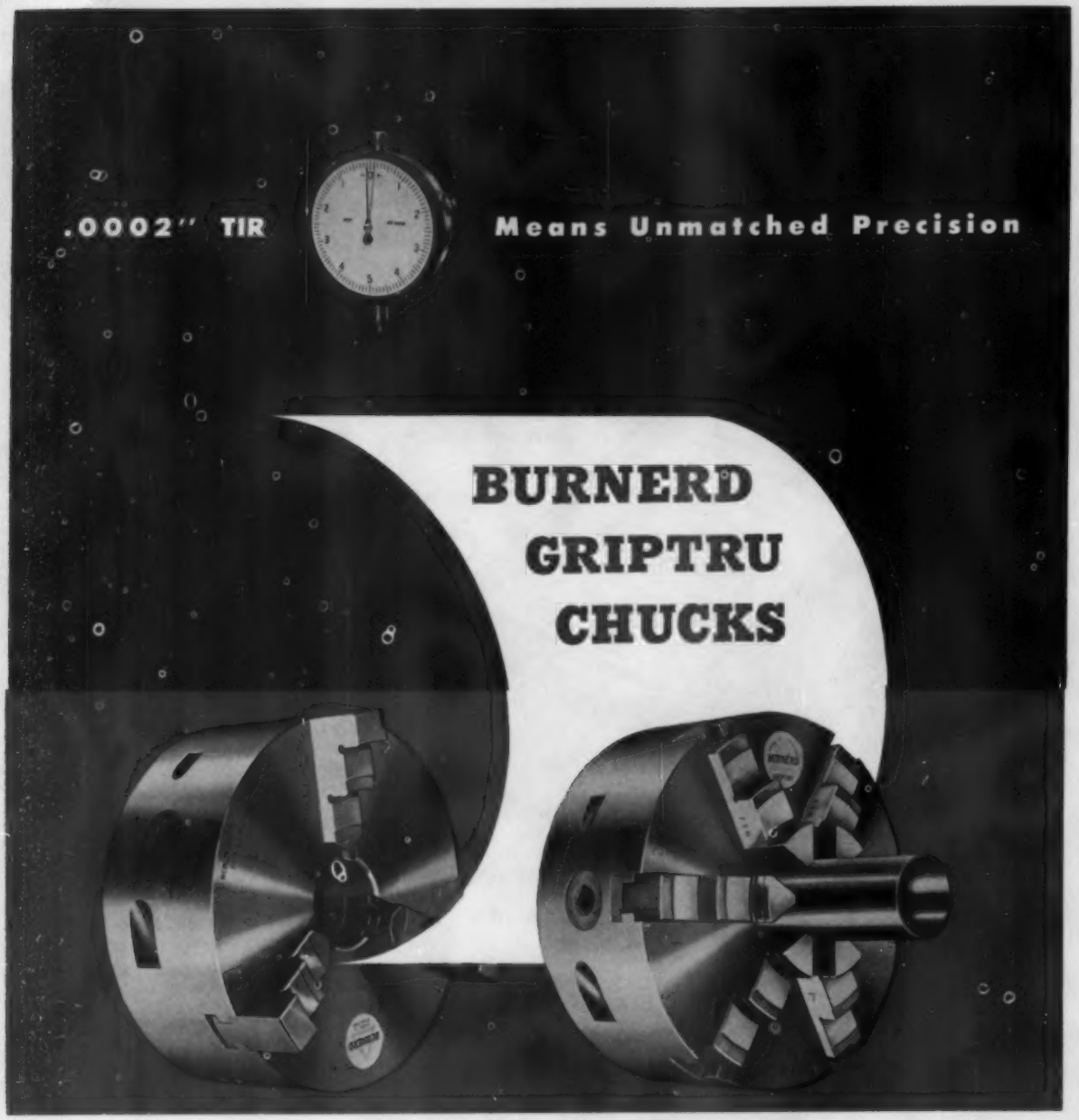

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REFERENCE BOOK SHEET

Hot-Work Steels—I

By Joseph S Pendleton, Jr, metallurgist, Tool & Alloy Steels, Carpenter Steel Co, Reading, Pa

Adapted from TOOL STEEL SIMPLIFIED (Third Edition)—to be published soon by the Carpenter Steel Co.

Service conditions make desirable some or all of the following properties in any hot-work steels:

I. Resistance to mechanical stresses set up by:
- (a) Shock or impact
- (b) Compression
- (c) Splitting
- (d) Friction

II. Resistance to thermal service:
- (a) High operating temperatures
- (b) Thermal shock

Mechanical Stresses. Many hot-work tools are subjected to shock or impact. In flat dies, the effects of impact are distributed over the surface, but in closed-impression dies the stresses are concentrated at corners or projections. In such dies, toughness is essential at the expense of other qualities.

Compressive stresses tend to upset the die itself. Compression is resisted by the hardness and strength of the die steel at the temperature of operation. For resistance to compression, the highest degree of red hardness is desirable.

Splitting stresses are those which tend to break the die or tool apart, as illustrated points *A* in Fig. 1. Splitting stresses are resisted by toughness. It is necessary, therefore, to put hot-work steels into service at a considerably lower hardness than for cutting tools. The initial hardness of the tool is further decreased when it becomes heated in service. At working temperature, most hot-die steels are in a condition where they have sufficient ductility to deform before they break.

Friction wears the tool by abrasion and galling. The most desirable steel to resist frictional wear is one with high red-hardness and a structure containing a surplus of hard carbide constituents in high-speed steel.

Thermal Service. The operating temperature is the maximum temperature which the face of the die or tool reaches in service. This is always higher than the average temperature of the tool. In tools such as extrusion dies and hot compression dies, where the hot metal is in continuous contact with the die for appreciable times, the temperature differential is great, because local heating is intense. In forging dies where contact is intermittent, heat dissipation tends to equalize the temperature. To withstand such service, qualities of both red-hardness and high resistance to softening by drawing action, resulting from repeated heating, are desirable.

Thermal shock is caused by repeated and abrupt heating and cooling. There are some operations, as for example piercing, in which the temperatures are so high, and the contact time so long, that the tool will quickly heat to above its annealing temperature if it is not cooled. It is necessary, therefore, to cool such tools after each piece is made, usually in water.

Because the most intense heating is on the surface, this repeated heating and cooling has the effect of rapidly expanding and contracting the surface layer. To withstand such service the steel must be very ductile through the entire temperature range encountered in service; otherwise the surface of the tool will develop heat checks. See Fig. 2. Steels of very high red-hardness are most susceptible to heat checking. Hence, steel selection is a compromise.

We shall now discuss hot-work steels in their relation to the above qualifications.

Types of Hot-Work Steels. There are two general types of hot-work steels:

1. Those in which the principal

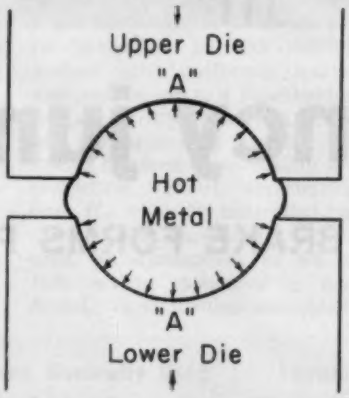
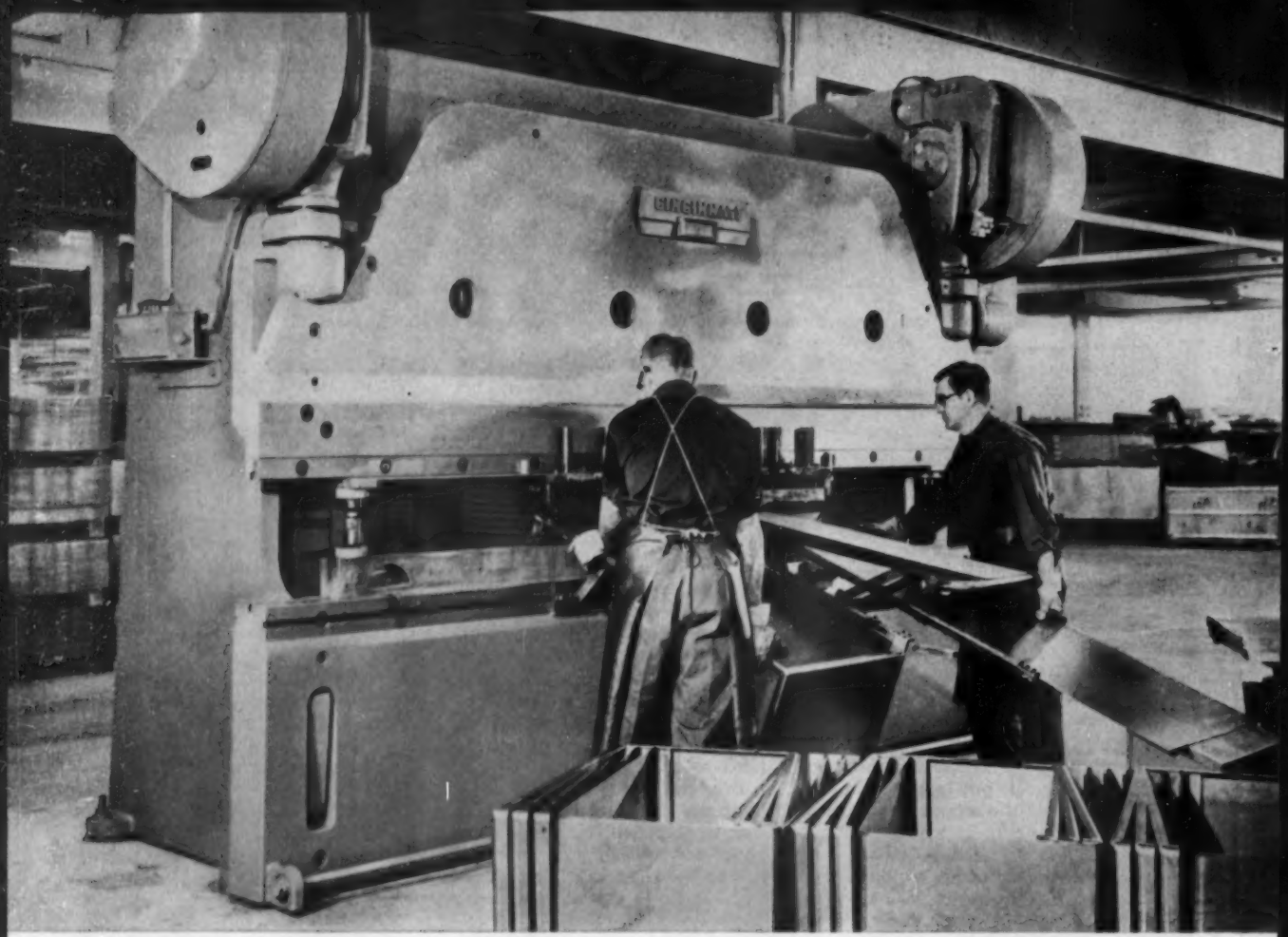


Fig. 1 — Compression stresses acting within an impression tend to split the die members. Here splitting stresses are concentrated at points *A*

Fig. 2—Heat checks on the nose of a hot-piercing mandrel are caused by rapid expansion and contraction of the surface layer by repeated heating and cooling



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Hot-Work Steels—II

element for red-hardness is tungsten (or molybdenum), and

2. Those in which the principal element for red-hardness is chromium.

Steels of Type I are characterized by high red-hardness, but are in general susceptible to heat checking. Of the desirable properties listed, they possess particularly resistance to compression, wear and high operating temperatures.

Steels of Type 2 have less red-hardness than the high tungsten steels, but are tougher and much less susceptible to heat checking. Therefore they possess particularly properties such as resistance to shock, splitting and thermal shock.

There are a number of compositions falling under each of these two classes, each having a set of properties which adapts it best to some specific application. However, the composition in each class which most nearly meets the requirements of average hot-work applications is given in Table I.

We can summarize by saying that 9% tungsten is adapted to tools requiring great red-hardness and resistance to wear, and in which toughness is not so important: the 5% chrome types are adapted to tools requiring red-hardness but also great toughness. Tools subject to extremely high temperatures can be cooled with minimum danger of heat checking if made from 5% chrome.

Heat-Treatment of Hot-Work Steels

9% Tungsten Hot-Work Steel. For forging, the 9% tungsten type should be heated to 2000-2050 F, preferably in a slightly oxidizing atmosphere. Working should be stopped before the temperature drops to 1600 F, and the steel should be reheated as often as necessary.

Small simple forgings may be cooled slowly in lime, but the best practice for large forgings is to place them in a furnace heated to about 1550 F, soak uniformly at this temperature, and then shut off the heat and cool slowly in the furnace. When the forging is cool it should be annealed. Normalizing of forgings is not recommended.

The best annealing procedure is to pack in cast-iron borings, heat uniformly to 1550-1600 F, and cool very slowly in the furnace. Resulting Brinell hardness should be 228 maximum.

For hardening, tools should first be preheated at 1500-1550 F, soaked until uniformly heated, and transferred to a superheating furnace at 2150-2200 F. A reducing atmosphere is necessary to insure freedom from scaling and protection against decarburization. If a manually controlled furnace of the gas-curtain type is used, an atmosphere of 6% to 12% carbon monoxide is preferred. In controlled-atmosphere furnaces the recommended dew point is usually about 8 F. After heating uniformly, tools may be quenched in oil or cooled in air. Salt-bath hardening is, of course, also recommended.

After cooling to about room temperature, the hardened tools should be drawn for at least one hour. The drawing temperature should be at least as high as the operating temperature. Tools can be left harder for any given service if the forger will warm them thoroughly before putting them to work.

5% Chrome Hot-Work Steels. Both variations of this type are heat treated alike, with identical resulting hardnesses. For forging, they should be heated to an initial temperature of 2000-2075 F, preferably in a slightly oxidizing atmosphere. Working should be stopped before the temperature drops to 1650 F.

Pack annealing at 1550-1600 F should give a Brinell hardness of 223 maximum.

Tools may be hardened without danger of decarburization in salt baths, in endothermally generated controlled-atmosphere furnaces maintaining a dew point of about 46 and a range of 40-55, or in manually controlled furnaces if the atmosphere is adjusted for 1 to 3% excess oxygen. Tools may be cooled in air or quenched in oil. When air treating, the empty furnace should be heated to 1850-1875 F.

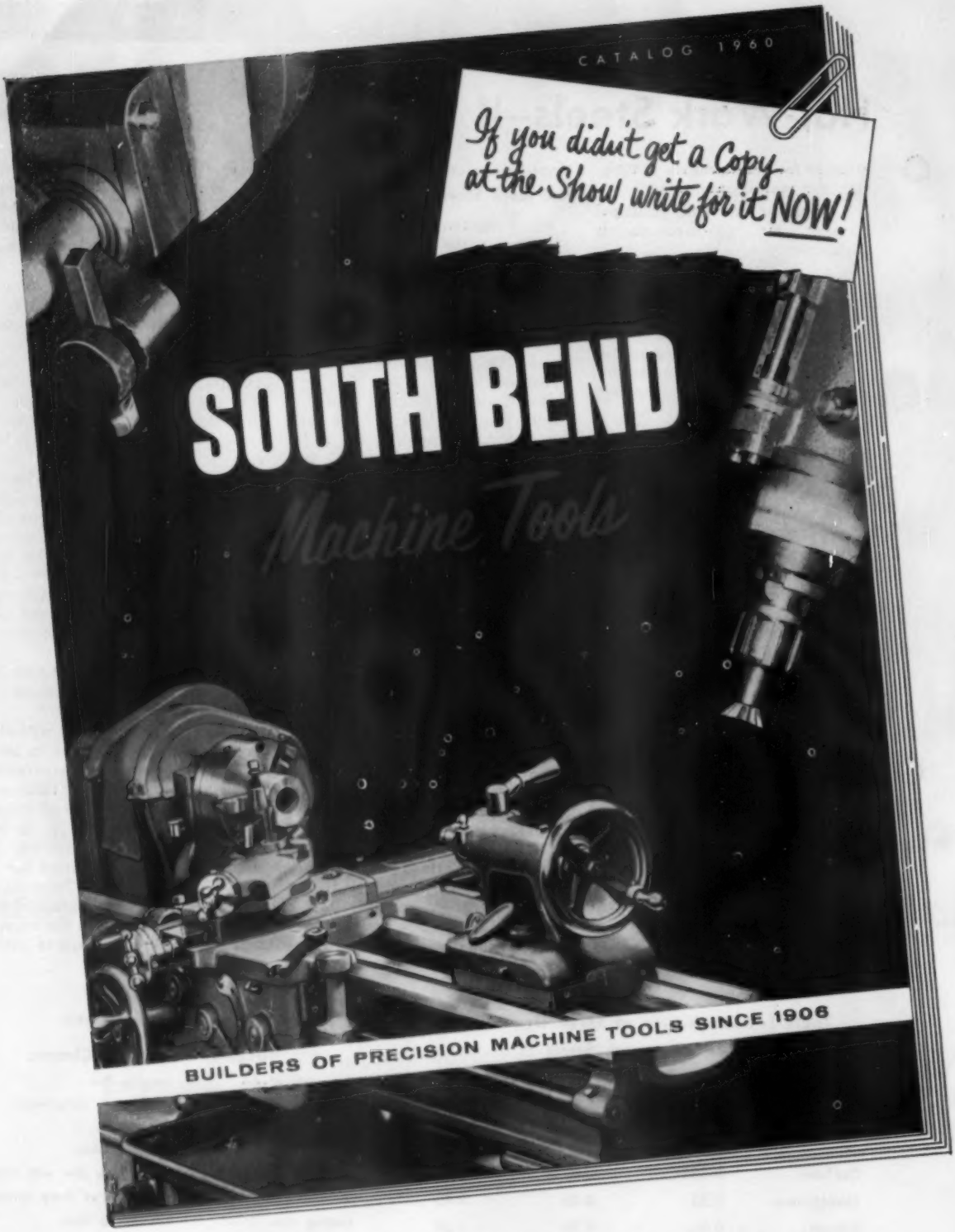
Table I—Compositions of Three Generally Used Hot-work Steels

	9% Tungsten Type* (Red-Hard)	5% Chrome Type (Red-Tough)	5% Chrome Type with Tungsten (Alternate Red-Tough)
Carbon	0.35%	0.40%	0.35%
Manganese	0.30	0.35	0.45
Silicon	0.30	1.10	1.00
Chromium	3.50	5.00	5.00
Tungsten	9.00	—	1.25
Vanadium	0.40	0.90	0.25
Molybdenum	—	1.35	1.50

* Some steels of this type contain 10% tungsten.

Typical Uses for Hot-Work Steels

9% Tungsten	5% Chrome
Hot shear blades	Forging dies
Hot gripper dies	Heavy-duty compression tools
Dummy blocks for hot extrusion	Bulldozer dies
Hot extrusion dies	Hot-forging dies with deep recesses or sharp corners
Die-casting dies	Die-casting dies
Forging dies	Aluminum-extrusion dies
Bending dies	Bolt dies
Punch and die inserts	Hot-piercing and forming punches
Hot compression tools not subject to sharp blows	Vanstoning dies
Hot punches for drawing or piercing	
Brass-extrusion dies	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Hot-Work Steels—III

When oil treating, the hardening temperature should be dropped to 1825-1850 F.

Hardened tools should be drawn for at least one hour. Because a secondary hardening range occurs at 950-1000 F, there is no reason for drawing at lower temperature.

Hardness after either air treating or oil treating, and then drawing at various temperatures is shown in Table II. Hot Brinell hardnesses are shown in Table III.

Let us now consider applications of these steels, to illustrate the principles discussed:

Forging. In flat-die forging, the contact time is so short that usually a die steel with high red-hard properties is not necessary. Closed-impression dies, however, are often exposed to both continued high temperature and high frictional wear.

In drop forging, the impact is intermittent. While dies should possess some red-hardness, the principal requirements are toughness to withstand shock and freedom from checking. Drop-forging dies are usually made from a chrome-nickel-molybdenum steel containing about 0.40% carbon, such as a modified SAE 4340 type, instead of the hot-work steels.

In the forging machine or upset method, forgings are produced by squeeze pressure. The closed-impression dies serve a double duty, being designed to grip the stock as well as to carry impressions. For the gripper dies the 9% tungsten type is usually preferable. For punches, if the tools are water cooled, or if runs are short, the 5% chromium steel will serve best. On long runs, the 9% tungsten is usually preferable.

In press forging of steel, brass and bronze, the die inserts should have high red-hardness and resistance to heat checking. Both the 9% tungsten and the 5% chromium types are used. Experience often dictates which steel is preferable.

Hot Extrusion. In horizontal equipment, the die and the dummy block receive most abuse from the standpoints of both high temperature and abrasion, and must withstand splitting and checking.

The 9% tungsten steel usually is recommended for the dummy block for brass extrusion, but in extruding aluminum the 5% chrome steel is satisfactory. The dies for extruding magnesium and aluminum, which normally are not heated over 900 F, are usually made from one of the 5% chromium steels. For brass and copper, also steels, use 9% tungsten steel.

Die Casting. Where long runs are essential it is often desirable to use 5% chrome hot-work steel on aluminum and magnesium alloys. On copper and brass with casting temperatures over 1600 F, use 9% tungsten steel.

Table II—Effect of Drawing Temperature on Hardness at Room Temperature of Hot-Work Steels

Drawing Temperature	9% Tungsten†	5% Chromium Steel‡
	Rockwell Hardness	Rockwell Hardness
As hardened	C 52-54	C 55-56
800 F	52-54	55-56
900	52-54	55-56
950	53-54	55-56
1000	54-55	55-56
1050	54-55	54-55
1100	51-53	49-50
1150	51-52	42-43
1200	46-48	39-40
1250	41-42	33-34
1300	37-38	29-30

Virtually the same hardnesses will result from oil quenching.
†Air quenched from 2175 F and drawn one hour at heat.
‡Air quenched from 1875 F and drawn one hour at heat.

Table III—Hot Brinell Hardness of Hot-Work Steels at Various Temperatures

Temperature	9% Tungsten†	5% Chromium Steel‡
	Hot Brinell Hardness	Hot Brinell Hardness
700 F		435
750	520	
850	476	
900		401
1000	435	385
1050		356
1100	370	330
1150	330	287
1200	220	220

†Air quenched from 2175 F and drawn one hour at 50 F above testing temperature
‡Air quenched from 1875 F and drawn two hours at 1050 F

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Talking Shop...

Reliability Factor

A GRAPHIC EXAMPLE of the reason for the increasing interest in product reliability is given in a recent issue of the employee paper at Allison: If your cigarette lighter works 99 times out of 100, you consider it quite reliable. There are four critical elements in a lighter—wheel, flint, wick, and fuel. Each must work 997 times out of 1000 for the lighter to work 99% of the time. In an Allison prop-jet engine there are 2000 critical items, so each must have an average reliability of 99.9995% for the engine to have 99% reliability.

Nailing It Down

THIS YEAR THEY replaced one-fourth of the planking on Atlantic City's 6-mile boardwalk. To nail down 800,000 board feet of joist and 825,000 board feet of planking took some 4 million galvanized steel nails. Carpenters drove the nails with compressed-air tools.

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Cutting Hardened 4140

A PROBLEM with cutting tools arose at Goulds Pumps, Seneca Falls, NY. The company had over 400 hex head bolts made of 4140 hardened to Rh 42C. These bolts had a ¾-16 thread and it became necessary to turn them down to ⅝ in. and rethread them. The bolts were 4 in. long, with the thread length 3½ in.

The machining operations on hardened 4140 were tried on a Bardons & Oliver running at 1015 rpm (200 sfm). The depth of cut was 1/16 in. and the feed was 0.006 in. No coolant. A ceramic tool was tried, but it fractured on the threaded portion of the bolt. A variety of carbide tools were tried with a life of three to five bolts per cutting edge.

The last 300 bolts were turned with a VR-65 carbide bit, and three of the cutting edges were used. The average was thus 100 bolts per cutting edge.

Industrial Water

AN ELOQUENT PREACHER in a riverfront town is said to have wound-up his sermons by thanking Heaven for directing all the big rivers to run through the big cities. That this good man had his priorities misplaced is pointed out by W D Mogerman, in International Nickel's Corrosion Reporter, in a fascinating account of the development of high-purity water and its application in industry.

Television tube manufacture requires high-purity water for preliminary rinsing of tubes and the settling and washing of phosphor coatings. Minute impurities in the water can cause defects in the picture. Such water is necessary in the production of transistors, in washing some ceramic products before firing, for making plating baths, anodizing aluminum, and for silvering mirrors.

Kissing Crisis

IN DUST-FREE "white rooms," workers wear special caps and clothing (usually dacron) and the general rule is that women wear no make-up. At Leach Corp, a Los Angles electronics firm, the girls agreed to give up face powder but revolted at the prospect of no lipstick. Officials finally solved the crisis by agreeing to the use of the "no flake, no smear" variety. This seemed to pose a problem of inspecting the lipstick being worn to make sure that it was the indelible kind. Leach solved *that* problem by buying the lipstick by the case, distributing it free to the girls.

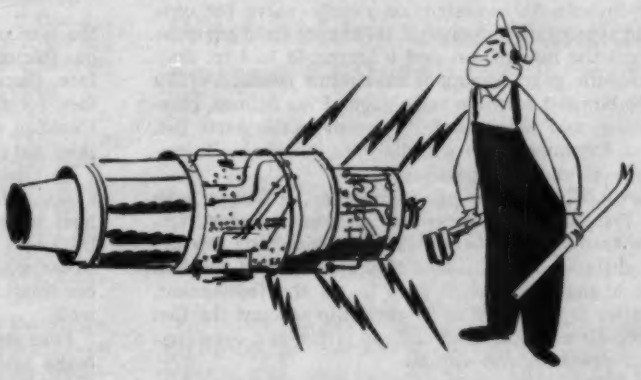
Bewildering Title

IF YOU WERE CONFUSED when Part 3 of Step 13 in Paquin's famous 14 Steps to Design A Die seemed to appear in our Sept 5 issue, you were right in thinking you had not seen parts 1 and 2. That was really part 1 of Step 13. The plates have been made for the titles of all three parts and the wrong plate was inserted by mistake, discovered just too late. Part 2 will appear in the next issue and Part 3 in a later issue.

Jet Electricity

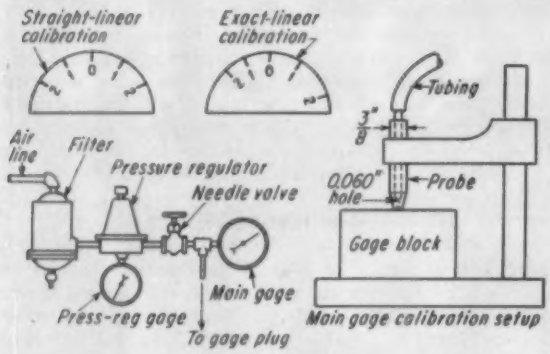
TO MEET THE PEAK power loads, electric companies must have generating capacity far above average requirements—thus normally must build steam or hydraulic stations that are used only a few hours a day.

An engineer from Bristol Siddeley engines recently told ASME how his company met the problem by hooking an aircraft turbine engine to an electric generator. Fuel costs are much higher than a conventional oil-fired steam generating system, but for intermittent peak load use, this cost is more than offset by the low initial investment, quick starting, low maintenance, and small size.



Practical Ideas...

Simple Parts Make Efficient Air-Gage Head



The outstanding advantages of the air gage are the great magnification made possible through pneumatic means and the ease of measuring in very small units. It is basically a simple tool, mainly made up of gages, pipe fittings, and flexible tubing which convert air pressure into a dimensional reading on a dial.

Any air gaging system is based on the principle of measuring the pressure of confined air, or back pressure, in back of an opening through which some air escapes. To wit: When a pressure gage is tapped into an air line whose end is open, i.e. air escapes as fast as it enters, no pressure reading will show. If the line is capped, full pressure will be indicated. Should a small hole be drilled in the cap, a portion of the air would escape and the gage would show the pressure of the confined air or, full pressure minus the loss.

Therefore, because of the simplicity of this system, an accurate air gage can easily be made from parts readily obtainable. Equipment for a low-cost set could be bought for approximately $10. A very good set will be about $30. Time to assemble the parts, less calibration = about 2 hrs.

The parts needed are: An air filter to keep dirt out of the system, a pressure regulator, to reduce the shop-line pressure to a low, steady, working pressure. (For all practical purposes, 30 p.s.i. is ideal, but other pressures can also be used.) Also an air-pressure gage with 60 p.s.i. maximum reading for the pressure regulator, an adjustable-restriction needle valve for controlling the magnification and setting of the system as it meters the flow of air, and a larger (3 to 4 in. dia) air-pressure gage having a maximum reading of 30 p.s.i. to be used as the master gage. Pipe fittings, plastic tubing, and tube couplings complete the parts list. Parts are connected as per diagram, keeping all connections as short as possible.

There are two ways of calibrating the master-gage dial. The straight-linear method, used by most air-gage manufacturers, in which all graduations are the same distance apart. And the exact-linear method where a gaging probe is used to set the instrument. The latter is preferred as it takes into account the fact that the air escaping from a fixed orifice is a combination of pressure and volume.

The first method merely calls for changing the 0-7½-15-22½-30 p.s.i. markings to read 2-1-0-1-2 with 10 divisions between each numeral. This is done by marking a plain dial pasted over the original. The second method requires a height-gage probe in conjunction with gage blocks.

The probe is made of ⅜ in. drill rod, turned at one end to 3/16 in. for the tubing connection and with a taper to ¼ in. at the other. An output orifice, measuring 0.060 ± 0.0015 in., is drilled in the tapered end and into a larger hole running the rest of the way through the probe. The output end is hardened and ground square with the body. In addition to aiding in calibrating the gage, the probe is later used to check parallelism and OD's on production jobs.

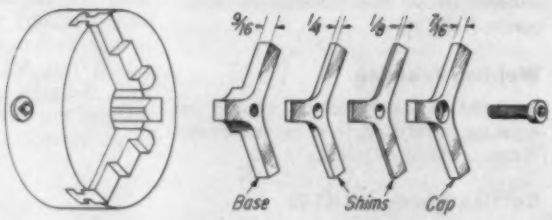
Mounted vertically in a stand, such as an indicator bracket, the probe is connected to the master gage and positioned for calibrating. Five gage blocks, differing by 0.001 in., are used. The largest, together with a 0.0015 in. shim, sets the height of the probe where it is locked. The shim is then removed and after the pressure regulator is set to deliver 30 p.s.i. the needle valve is adjusted so the master gage reads 30 p.s.i. This location is marked with a 2 on a dial face.

Each succeedingly smaller block is placed under the probe, marking the location of each reading so the new dial will read 2-1-0-1-2 as at top center of sketch. Ten equally spaced divisions are then marked between numerals to represent differentials of 0.0001 in.

The manufacture and application of gage plugs to be used with this setup was described in *AM/MM*—July 25, '60, p134.

J H Sperman, Brooklyn, NY

Chuck Shims Set Parallelism



Much of our lathe work involves facing pieces of various thicknesses parallel with an already machined back face. Consequently, we depend entirely on the chuck face for fast setups, but all too often is some kind of blocking necessary to stand off the work as the chuck jaws extend 1½ in. from the face.

To eliminate temporary blocks or parallels, I made a base shim with a pilot to fit the bore of the chuck, as well as a cap and intermediate shims for numerous thickness combinations. Dimensions and shape of the shims will vary with each individual chuck, but for our small 8-in. job the following combination has served well.

Four steel plates with a combined thickness of 1⅜ in. make up the entire unit. They are all cut to 4¾ in. diameters, the base being 1 in. thick and turned down to form a 7/16 in. high pilot, allowing 9/16 in. shim

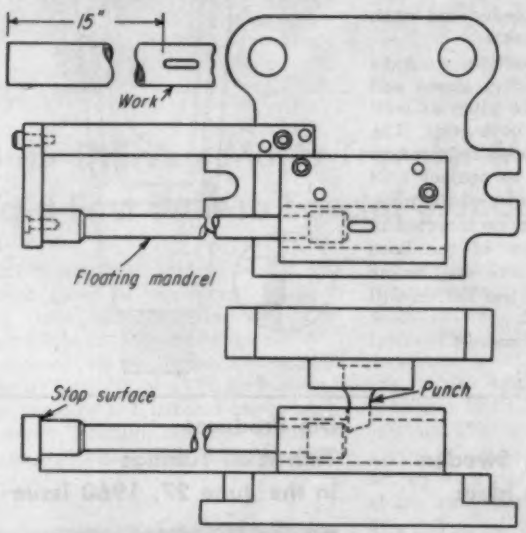
thickness. It's then drilled and tapped for a capscrew. The two intermediate shims are ⅛ in. and ¼ in. thick respectively. They are also center drilled. Cap is 7/16 in.

Cutaways, to provide clearance for the chuck jaws must now be made. They can be cut in each part independently or through the whole stack while they are bolted together. The number and depth of the cuts depend on number of chuck jaws and the purpose for which the shims are to be used. The ones shown are for a three-jaw chuck and the cuts are deep enough to permit the jaws closing on a 1-in. piece.

By bolting the cap to the base with either or both shims, or by using just the base, or base and cap, the following thickness combinations are possible: 9/16 in., 1 in., 1⅛ in., 1¼ in., and 1⅜ in.

Julius B Hassler, Nashville, Ill

Floating Mandrel Prevents Tube Distortion



We recently had the problem of punching a 3/16 x ½-in. slot in a 1" O.D. x 0.049-in. wall steel tubing. Ordinarily this would have been no problem except this slot was to be punched 15" from the end of the tube. We did not want to use the ordinary type of horn die because of the large length-to-diameter ratio of the horn.

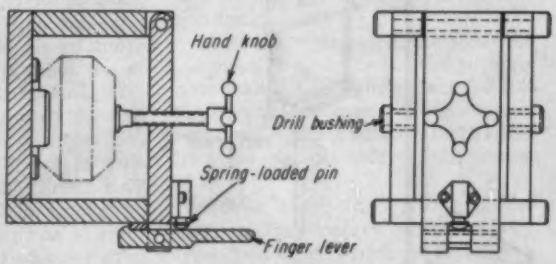
In making the punch, the die block was bored to a slip fit over the O.D. of the tube, and the mandrel a slip fit in the I.D. For less friction when loading and unloading the mandrel was relieved to a smaller diameter in the middle section. By pivoting it through the center line of the die block bore the mandrel was made to float causing less strain than a solid mount. The punch itself was ground with about a 3/32-in. shear and a slight concavity from front to back.

We first tried the die without a mandrel in the design shown, leaving the tube without inside support. Since the tube distorted where the punch entered, the mandrel was added.

In operation, a tube to be punched is slipped into the end of the die block and over the mandrel until it butts against the stop surface. The mandrel must be centered by hand as its beveled end contacts the front of the tube. After punching, the blank is removed from the die along with the tube.

Gene A Norman, tool engineer, Breuer Electric Mfg Co, Chicago, Ill

Snap Lock Cuts Jig Box Loading Time



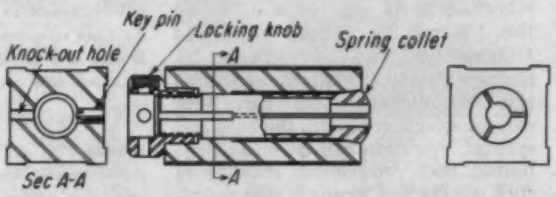
This lock was designed to speed locking and unlocking operations on our jig boxes. The design illustrated is much faster to operate than most standard boxes.

The lock consists of a simple finger lever with a low pressure spring. The lever is placed in a slot in the lid and doweled in place so that it pivots on this dowel. A standard low pressure spring acts against the finger lever for positive locking action. Caution must be taken to insure that the length of lip on the finger lever is shorter than the stroke of the spring stop. The hand knob need only be turned one turn to lock and once to unlock it in order to operate the lever. When removing a piece of work, it is necessary to press the lever toward the hand knob, then flip the lid open. The entire operation can be done with one hand.

This lock gives the operator the added advantage of a lid that is always parallel to the work piece. It allows the addition of bushings on the lid side of the jig if necessary.

Victor DiNatale, tool designer, Breuer Electric Mfg Co, Chicago, Ill

Workholder Uses Standard Spring Collets



Tool above has many uses around a milling machine, drill press, grinder and bench vise. It often takes the place of a dividing head when round work has to have squares, flats, or angular surfaces machined on it.

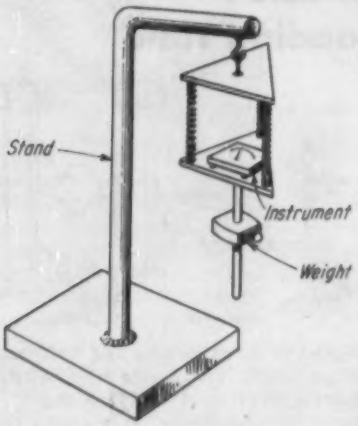
It is particularly handy in mold work when a punch,

which has been milled in this holder, requires hand work in the bench vise. Holder and punch can then be moved as a unit for better manipulation and returned to the miller if necessary. Drilling of diametrical-cross holes through round stock is also simplified with the holder.

Built around spring collets borrowed from a bench lathe, the block is squared up and bored axially with a taper at one end to suit the collets and counter bored at the other for the locking knob. All side faces are then relieved to provide more accurate landings. After hardening, the block is ground all over so the bore is equidistant from all four sides.

The locking knob is turned to rotate freely in the counterbore and is bored with a thread to fit the collets. Its head is knurled and drilled for a torque pin or spanner wrench to ease tightening. A flatted round pin enters the side engaging the keyway in the collet to prevent its rotating while being tightened.

M. W. Loftus, Chicago, Ill



Springs Stop Instrument Vibration

Any direct reading instrument, such as a galvanometer, will not read accurately if vibration interferes with its operation. In addition to inducing motion which makes the instrument inaccurate, continued vibration will cause permanent damage.

In this instance a galvanometer was mounted atop a column resting on a shop floor on which heavy machinery was running. The vibrations of these machines were transmitted through the floor and column to the galvanometer. The resulting motion was so violent, the instrument could not be read.

To remedy this situation the instrument had to be isolated so the vibration could not reach it. To do this, I placed it on a base which was attached to the column only by springs. Practically all of the vibration was absorbed in this way. With careful selection of both the base and springs, vibration can be made negligible. Both components must be of such weight and strength that resonance is prevented in the system. A weight is added for greater stability when the instrument is light.

John Obrebski, metallurgist, Monarch Machine Tool Co, Sidney, Ohio

Teflon Improves Cock Plug

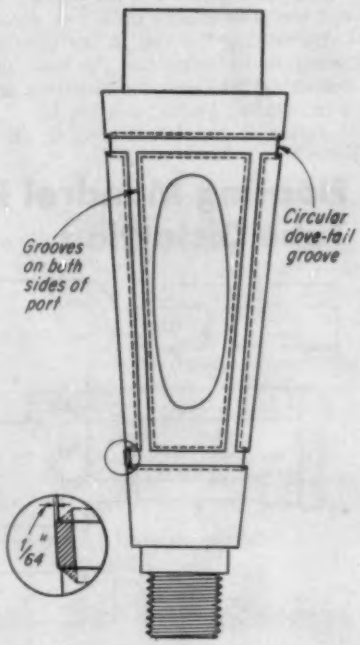
Maintenence work in a chemical plant involves periodic overhaul of pipe-line shut offs. These are most often in the form of cocks which, in our case, are made of 316 SS.

Because of the necessity of a perfect fit between the plug and the cock body, there is sometimes a tendency of the plug seizing in its seat. This usually happens when the shut-off is most urgently needed and when there is no time to waste.

To remedy the situation, we have inserted strips of Teflon above and below the port in the plug, as well as on either side at both ends. The strips are held in dove-tailed grooves which permit them to project 1/64 in. outside the periphery of the plug.

Before the plug can be inserted in the body, smoothness of the bore must be assured. There can be no burrs or grooves lest the Tefton will be torn or deformed.

R W Louwein, Celanese Chemical Co, Bishop, Texas



Hjalmar Dahl Upplands Vasby, Sweden Won $25 for his idea:

Die Produces Thin-Wall Tubings in the June 27, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

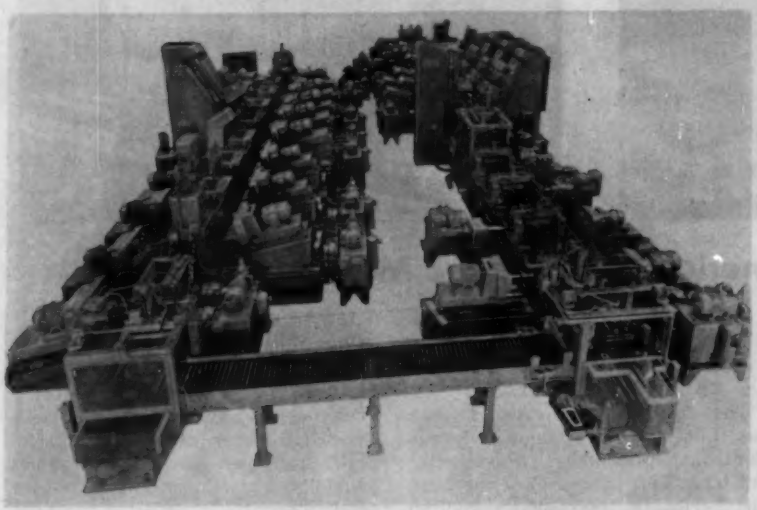
JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc., and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

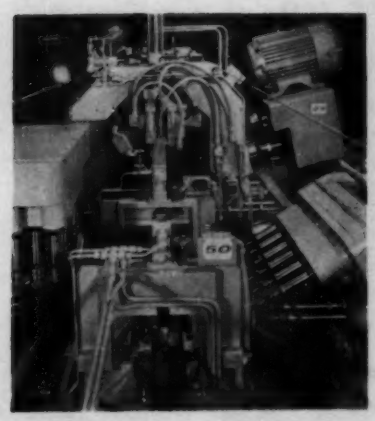
HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

New Shop Equipment
Materials and Parts



Buhr Delivers Major Transfer Machine Said First Built to Special Standards

This Economatic, said to be the first major piece of equipment built to the new Special Machine Tool Standards, has been completed and delivered to its owner, American Motors Corp. Dubbed "Buhr's Baby," the machine is a lift-and-carry, part-through transfer machine with 58 stations. It was designed to perform 323 precision operations in automatic sequence on cylinder heads for 1961 automobiles.



Tapping heads at one station have tools set at both obtuse and acute angles to the workpiece

Operations, in addition to rough and finish machining, include: probing, sealer application, assembling, pressure testing, rejecting, and injecting. The work cycle is 30 sec, giving a capacity of 120 pieces an hr. In its progress through the machine, each part is rotated through 90° twice and tipped 90° four times to present appropriate faces to the tooling.

Because it is the first major machine to be built to the SMTS, this Economatic is said to be of special interest to other users and builders of multiple operation machine tools.

These standards, which are the result of joint effort between leading users and builders of multiple operation machine tools, govern such factors as mounting and attaching surfaces of main bases, wing bases, feed units, horizontal angular adapters, angular columns, and the bolting patterns of these units as well as the uniform work loading height and application of specifice components used in the construction of multiple operation machine tools.

By increasing the convertibility and flexibility of equipment, standardization has opened up new areas of application for transfer machines and increased their economy in areas where they have long been used. Now, in increasing numbers, the medium and small volume producer will be able to use these tools economically.

In addition to being the first major piece of equipment built to these new standards, Buhr's Baby is also interesting because it introduces basic engineering and design changes in areas not covered by the standards.

Among these innovations is the new hydraulically operated way type feed unit which is actually a compact power package with all controls panel-mounted directly on the side of the unit. Only three hydraulic lines need be disconnected to move or remove the units.

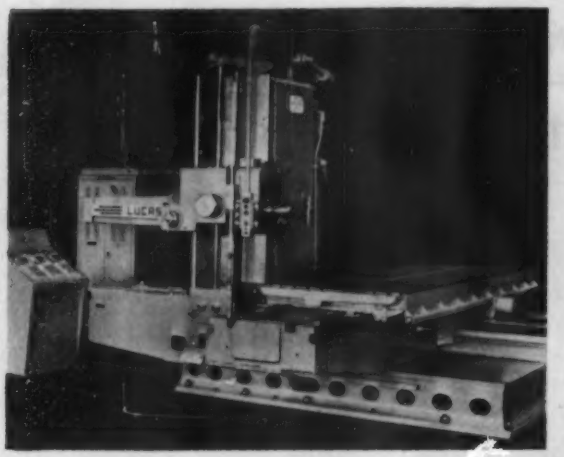
The new units also provide a 60% increase in rate of rapid traverse and a 50% increase in structural strength. Incorporation of a differential circuit reduces oil consumption 50%; this permits the use of smaller volume pumps.

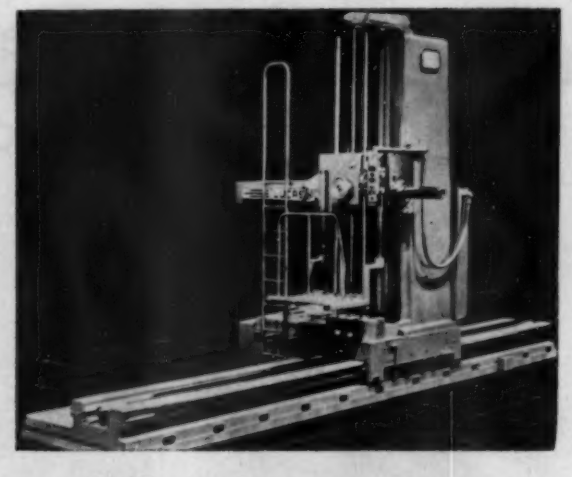
Buhr Machine Tool Co, Ann Arbor, Mich

MORE DATA? Circle 51, inside back cover

ZERO-MIST PILLS cure production headaches for electroplating industry. When added to chromic acid solutions, they prevent troublesome mist and spray from rising out of plating tanks (AM/MM — July 25 '60, p3) — *Udylite Corp, Detroit 11, Mich*

MORE DATA? Circle 52, inside back cover





Lucas Exhibits Two Numerically Controlled Machines at Show

The Model 542B84 table-type horizontal boring, drilling, and milling machine (left) and the Model 542B floor-type machine (right) were exhibited at the Machine Tool Exposition.

The table-type machine has a 5-in. spindle (No. 50 MM taper with power tool ejector) with speeds of 9—1200 rpm. Three-motion Lucas Numra-Tronic numerical positioning system controls the head, saddle, and table.

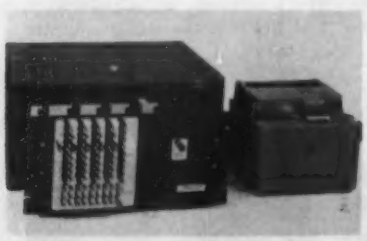
Other specifications include an 8-ft bed, 72-in. column, 72-in. backrest, a 48x86-in. table, and a 132-in. saddle. Table crossfeed is 71 in.

The floor-type machine (right) has Lucas two-motion Key-Tronic Control, a punch-key system without tape. Vertical travel of the head and horizontal travel of the column on the runway are selected from a data input system on the console. Other specifications include a 5-in. spindle, No. 50 MM taper with power tool ejector, speeds of 9—1200 rpm, 60-in. column travel, and 78-in. horizontal travel on column runway.

Lucas Numra-Tronic are Key-Tronic control systems are modified General Electric positioning units. Both machines can be operated manually from the multiple control pendant.

Lucas Machine Div, New Britain Machine Co, 12302 Kirby Ave, Cleveland 8, Ohio

MORE DATA? Circle 53, inside back cover



Photoelectric Tape Reader Reads Six 80-Bit Blocks a Sec

Model No. 200 photoelectric block-reading tape reader, claimed to be the first of its type, simultaneously reads 80 bits at speeds of up to six blocks per second.

The solid state amplifier section, which is rack mounted, has a simple plug matrix that promotes line-by-line or block reading. Tape motion is controlled by a simple photoelectric servo; however, the customer's equipment or any desired hole in the matrix can provide the stop code.

Because no clutches or brakes are needed, the reader requires little maintenance. As a matter of fact, the reader unit has only one moving part—the PMI printed drive motor.

Machine tool controls are the primary application of these readers.

Photocircuits Corp, 31 Sea Cliff Ave, Glen Cove, N Y

MORE DATA? Circle 54, inside back cover

Vac-U-Lift Eliminates Crimping In Handling Thin Sheet Material

The new six-pad unit is especially designed to handle and place very thin stainless steel sheets on an insulating board. Costly manual handling which produces crimping is eliminated.

The Powerpac, which is entirely self-contained, is mounted on a 48 in. beam that has three 20 in. cross-arms. Total rated capacity is 300 lb with a 2-to-1 safety factor.

Steel plates, tanks and concrete as well as many other nonporous materials are handled by Vac-U-Lift systems in weights ranging from a few ounces to several tons.

Vac-U-Lift Co, Salem, Ill

MORE DATA? Circle 55, inside back cover

Bench Model Tumbling Barrel Finishes Small Metal Parts

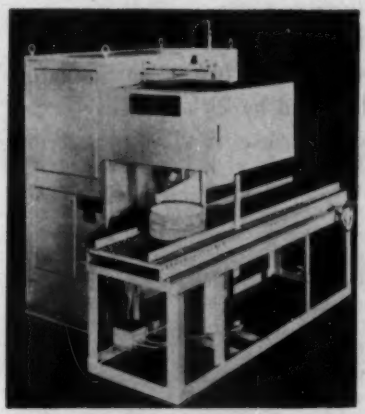
Model VT-70 bench model vibratory finishing machine is said to be especially suited for precision finish-

ing of instrument gears, missile components, electrical parts, and other small metal parts.

Machine is 14 in. long, 11½ in. wide, and 13¾ in. high. Tub has a capacity of ¾ gallon and can be removed from the top of the vibratory mechanism housing. Vibratory motion of the horizontal tub permits fine finishing, often at speeds 10 to 100 times faster than possible with conventional finishing machines.

Almco, Queen Products Div, King-Seeley Corp, Albert Lea, Minn

MORE DATA? Circle 56, inside back cover



Induction Heater Anneals Blanks up to 30 in. Diameter

This 60-cycle induction heater anneals aluminum blanks of various shapes (principally circular, rectangular, or oval) in sizes from 4—30 in. diameter, depending upon the size of the induction coil used. Unit heats the blanks in 12-in. stacks; thickness of material can range from 1/32 in. up. Heating time ranges from one minute per stack in the smallest diameter to 40 minutes maximum for the 30-in.-dia blanks.

Operator stacks blanks on conveyor, positions them under the heating coil, and presses the start button. Positioning guides retract automatically, the stack is hoisted into the coil, and the coil is energized for a pre-timed cycle. When the blanks are up to temperature the coil is de-energized.

Ajax Magnethermic Corp, Youngstown, Ohio

MORE DATA? Circle 57, inside back cover

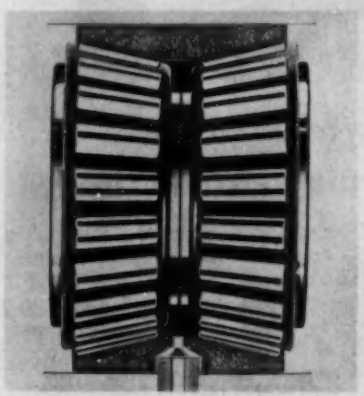
Singer Numerical Control System Controls 40-in. Table to 0.0002

Offering flexibility and economy of operation because it has a modular design, the new control system accurately positions a 40-in. work table to ± 0.0002 in. This accuracy is obtained, according to the manufacturer, because the actuating system is separated from the measuring system.

Modular components, which plant technicians can rapidly change with ease, include: tape reader, distributor, digital analog converter, notch phase discriminator, amplifier, dc power supply, motor gear drive, position indicator control, and servomicrometer.

Diehl Mfg Co, Somerville, N J

MORE DATA? Circle 58, inside back cover



Timken Pin-Type Bearings Adapted for Machine Tools

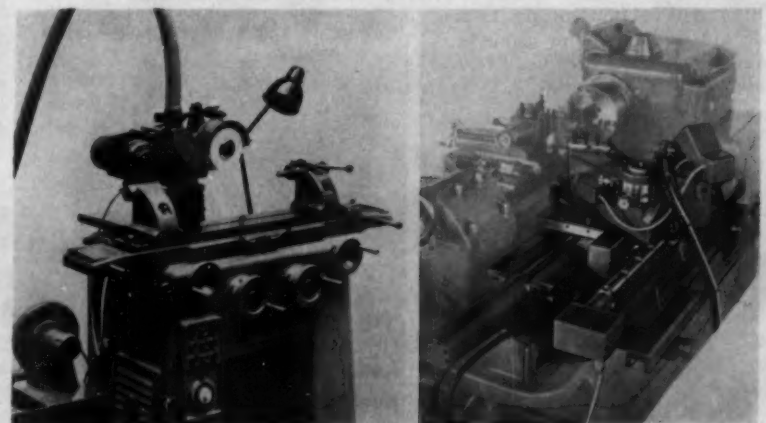
New pin-type double-cup bearings have been designed for machine builders whose equipment requires double-cup bearings in floating positions with loose cup fits. Because they are dimensionally interchangeable with conventional Timken double cup bearings, these new pin-type bearings can be used by machine builders with minimum changes to existing designs.

The Timken Roller Bearing Co, Canton 6, Ohio

MORE DATA? Circle 59, inside back cover

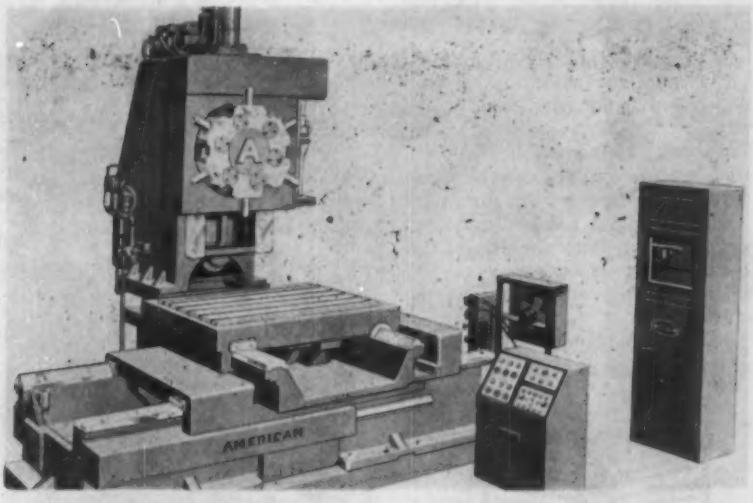
ULTRASONIC SPOT WELDER with new high-temperature transducer construction and unique self-tuning circuit is especially suited for semi-conductors, printed circuit boards, and foil-wound transformers and capacitors. Top piece may be up to 0.006 in. thick; there is no limit on bottom piece—*International Ultrasonics, Inc, 1697 Elizabeth Ave, Rahway, N J*

MORE DATA? Circle 60, inside back cover



INTRODUCED AT COLISEUM MACHINERY SHOW, new Elgin Ultra-Universal tool and cutter grinder Model AUL 500 (left) features patented grinding wheelhead that gives it a great versatility. It can also be used as standard cylindrical, internal, tangential, and surface grinder. The Man-Au-Cycle all-hydraulic tracing attachment (right) cuts in both directions and can make a full ¾-in. dia reduction on a single pass. Its maximum tracing length is 30 in., its stroke 4 in. —*S & S Machinery Co, 140 53rd St, Brooklyn 32, N Y*

MORE DATA? Circle 61, inside back cover



American Six-Spindle Turretdex Has 2-Axis Positioning Accurate to 0.00025 in.

Model AA-Turretdex—which drills, taps, reams, counterbores, and faces automatically — has a positioning table which moves up to 20x30 in. and positions to ±0.00025 in. Speeds, feeds, and tapping cycle for any or all of the six spindles can be preselected; positive stops with dwell give accurate facing and counterboring.

The spindles are heavy-duty alloy steel mounted with taper roller bearings, and are available with straight bore for No. 3 Morse Taper ASA adjustable adapter assembly or flanged nose for snub nose collet chucking tool for light milling. Ways of the turret column and positioning table are hardened and ground.

American Tool Works Co, Pearl at Eggleston Ave, Cincinnati 2, Ohio

MORE DATA? Circle 62, inside back cover

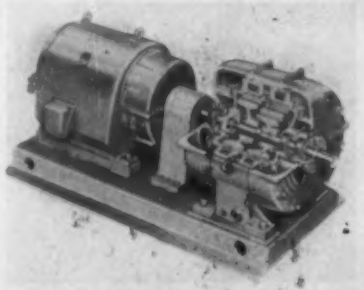
Special Purpose Thread Grinder Developed by US Electrical Tool

Unit features spindle adjustment for various lead angles and the motor is adjustable on its base with the angle of the spindle. Designed for engine lathe cross-slide mounting for thread grinding, it is available in a range of horsepowers and is furnished with matched Class 7 precision bearings and electronically balanced motor and spindle.

Grinder also incorporates a vertical feed adjustment for obtaining center line alignment and can be supplied with a built-in wheel dresser with necessary adjustments for various wheel angles. Pulleys can be supplied for several sizes of wheels, either resinoid or vitrified.

US Electrical Tool Co, 3640 Llewellyn St, Cincinnati 23, Ohio

MORE DATA? Circle 63, inside back cover



Adjustable Speed Magnetic Drives Have Ratings From 75 to 4000 hp

These drives incorporate simplified design with few moving parts and provide versatile adjustable speed performance over an automatically regulated 20:1 range.

The drive is based on a liquid cooled magnetic coupling design that features stationary field construction, bearings that can be relubricated without disassembly, and a cooling system that permits a planned flow of air through the drive at all times and eliminates any possibility of bearing condensation and drive flooding. Since coolant does not contact the adjustable speed member, water drag is eliminated and closer, more uniform speed regulation is obtained throughout its range. Drives operate from ac power and are offered as a complete package including drive unit with water controls, controller enclosure, and operator's station.

Louis Allis Co, 427 E Stewart St, Milwaukee 1, Wis

MORE DATA? Circle 64, inside back cover

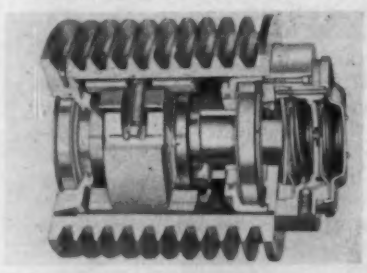
Dye-Penetrant Inspection System Introduced by Picker X-Ray

Pixchek, a system which is claimed to be economical and easy-to-operate, comes in a compact kit containing both spray and liquid cans for on-the-spot inspection. It also comes in bulk for installations that can be fitted into production lines for tight quality control of a volume output.

Unseen flaws are made visible with Pixchek when a chalk-white developer acts on a low-viscosity red dye. The developer draws the dye penetrant from the defect to make a red stain pattern on a white surface; the stain pattern reveals the type of surface flaw in the material.

Picker X-Ray, Sub of CIT Financial Corp, 23 S Broadway, White Plains, NY

MORE DATA? Circle 65, inside back cover



Power Transmission Accessory Reduces Power Consumption

Serving three purposes in electric or gasoline-engine drives, Power-Max combines an automatic clutch, adjustable torque selector, and variable starting time delay. Available in sizes from 3 to 2000-hp capacity, the drive unit is reported to eliminate the need for over-size and special motors, expensive starters and, at the same time, protects the power unit and driven mechanism.

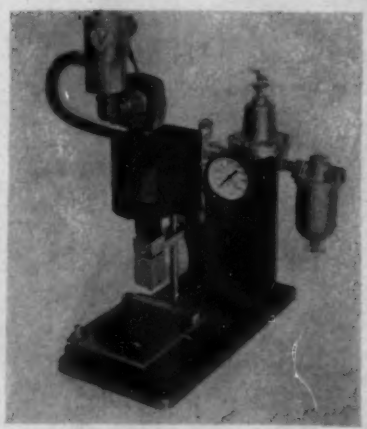
Device is a centrifugally operated

clutch which may be adjusted both for maximum torque transmitted and time delay in picking up the load. Typical installations include conveyors, agitators and mixers, punchpresses, and virtually any drive where high starting torque, shock loads, or other requirements are found.

Models are available for direct connection, for V-belt, or flat-belt drives. They can be provided with an integral brake drum or, since the unit operates in either direction, the motor can be reversed to act as a brake, without damage to the drive.

Olme Precision, Inc, 444 Masonic Bldg, Portsmouth, Ohio

MORE DATA? Circle 66, inside back cover



Marker Puts Unnoticeable Code On Parts after Manufacture

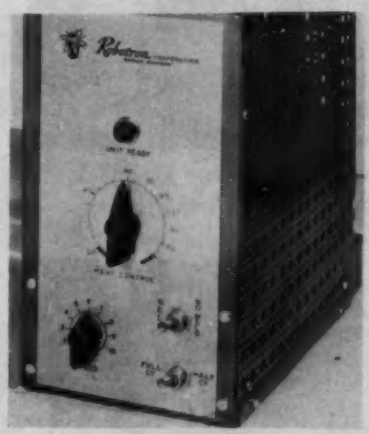
A cold code marking unit, which may be mounted singly or in series on a work bench, will place code symbols on items after their manufacture. The small unit (6 x 12 x 10 in.) will mark plastic, wood, metal, and fiber parts or products.

The unit has a fixed product holder, and an interchangeable holder for dies, which are retained by a setscrew. A form or template may be used with holder for positioning.

Complete outfit includes air filter, regulating valve, solenoid, quick exhaust, and pressure gage.

Acromark Co, 7-13 Morrell St, Elizabeth, NJ

MORE DATA? Circle 67, inside back cover



Compact Control for Resistance Welders Developed by Robotron

Designated model 10E76E-C this midget bench welder control for resistance welding is no bigger than a small portable radio (10 x 10 x 6 in.) It weighs only 21 lb.

Designed primarily for the electronic tube and art metal industries, it has maximum operation at 12 amp with a 50% duty cycle. The unit provides a weld time of ½—10 cycles and phase shift heat control is adjustable from 20%—100%. Thyratron contactor handles input of 115v to 230v, 50 or 60 cycles only.

Robotron Corp, 21300 W 8-Mile Rd, Detroit, Mich

MORE DATA? Circle 73, inside back cover

Drill for Circuit Panel Boards Makes up to 10,000 Holes an Hr

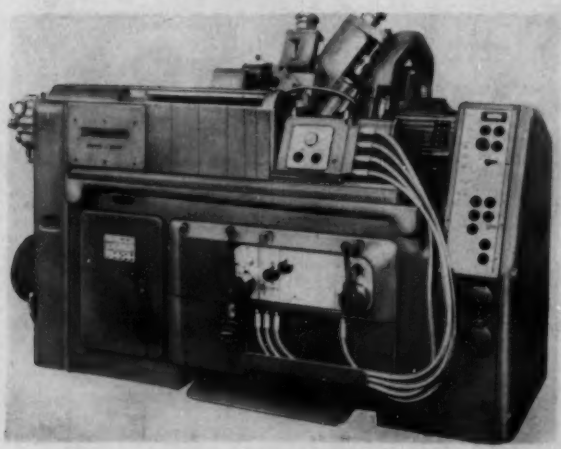
Model M-100, which was designed primarily for high production drilling of printed circuit panel boards, uses solenoid carbide drills while it maintains accuracy to ±0.005 in. It obtains the rated capacity of 10,000 holes per hour in epoxy glass because it drills six 1/16-in. stacked boards at one time, to a height of ⅜ in. Or, any number of boards may be drilled to the ⅜ in. maximum tool depth.

The drill, which will drill to the center of an 18-in. circle, is equally effective in drilling any flat material: aluminum, beryllium, copper, zinc, steel, or plastics.

Feed rate is completely adjustable from 0—4 ips; drill sizes range from No 60 through ⅛-in. solid carbide, with no supporting bushing required. Standard speed is 20,000 rpm, but an optional 45,000 model can be supplied. Price is $2750, fob Burbank.

Motion Control Machines, 2704 W Burbank Blvd, Burbank, Calif

MORE DATA? Circle 68, inside back cover



Swiss Tracer Lathe Does Automatic Cycling With up to Six Separate, Controlled Passes

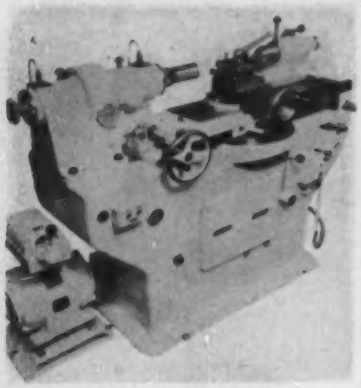
A new Dubied 517 automatic tracer lathe, made in Switzerland, has recently been introduced into the US. One of its special design features is provision for automatic cycling with up to six separate passes—each one controlled for diameter and length—with automatic change of spindle feeds and speeds for each pass, if required.

Because an accurate automatic tool turret is built into the lathe, a separate tool can be used for the finishing pass. The operation of cross slides is optional: manual or automatic. In the latter version, it can be automatically programmed into the work cycle.

Dist by Carl Hirschmann Co, Inc, 30 Park Ave, Manhasset, NY

MORE DATA? Circle 69, inside back cover

THESE PARTS ARE BEING PRODUCED AT SPEEDS OF 90 TO 250 PCS/MIN



Precision Lathe, for Diamond Tools, Has Wide Speed Range

This new Bryant Symons precision lathe has an infinitely variable speed drive for spindle speeds in the range from 250—2250 rpm. Designed primarily for machining metal components with diamond tools, the lathe also cuts with ceramic and carbide tooling.

The machine has a rigid cast iron base, a mirror finish Nitralloy spindle which is steel hardened, a self-aligning driving coupling, and a dynamically balanced driving pulley. Because the spindle has no gears or ball bearings, vibration is eliminated; instead the spindle is carried by two adjustable anti-friction steel bearings of long length. A V-belt drive is used.

Two sizes—8 in. and 13¼ in.—are available. Distance betwen centers is up to 28¼ in.; automatic feeds range from 0.001—0.005 ipr.

Milo Mfg Co, 259 N Broad St, Elizabeth, N J

MORE DATA? Circle 70, inside back cover

Immersible Transducer Converts Present Tanks For Ultrasonics

A new immersible transducer, constructed from all welded stainless steel, supposedly fits all present tanks used in degreasing and cleaning operations and will convert them for ultrasonic cleaning.

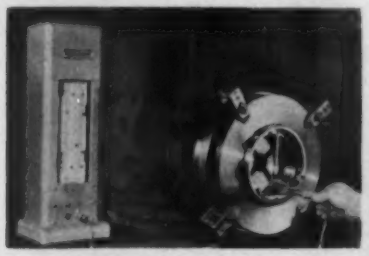
The new transducer is magnetostrictive and claims the advantages of continuous 300F operation, extra long life, and versatility.

The transducers, which have low voltage requirements, are built of durable nickel and stainless steel for continuous performance and reliability. The new system operates at 22KC for maximum cleaning efficiency with minimum noise level.

The new transducer comes in two models: The S-350-S is 12¾ in. long, 7¾ in. wide, and 4⅝ in. high; the S-350-L model is 17 x 4¾ x 4⅝ in.

Ultrasonic Dept, The Harris Transducer Corp, Woodbury, Conn

MORE DATA? Circle 71, inside back cover



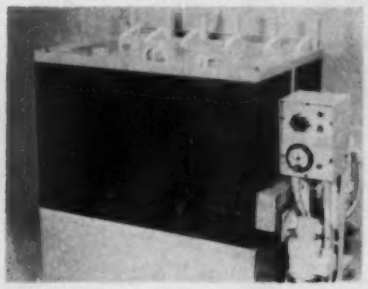
Precisionaire Gage Combines Low and High Amplification

This Dual-Amp gage combines low amplification of long gaging range and high amplification of close tolerance inspection—in sequence.

The right column of the gage shows part size within an 18 thousandths range and the left column spreads the final two thousandths over four inches. The gage, which is adjustable from 3—12 in. dia, is priced at $910, fob Dayton.

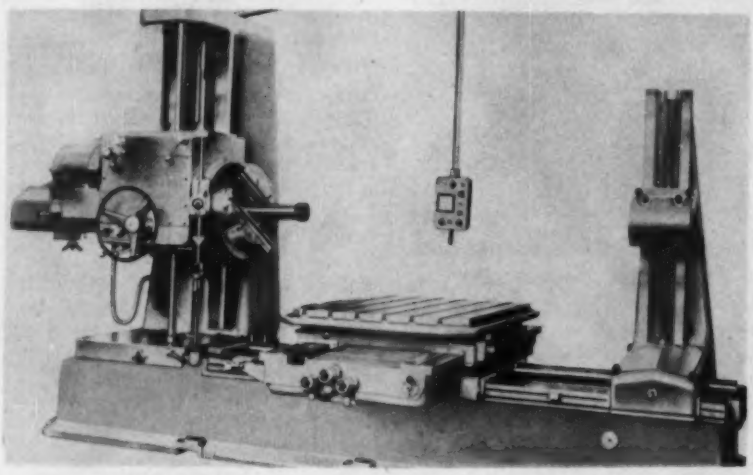
Sheffield Corp, Sub of The Bendix Corp, Dayton 1, Ohio

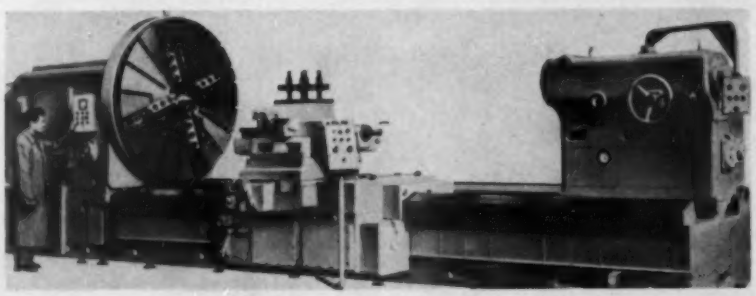
MORE DATA? Circle 72, inside back cover



Spray Etcher Etches 0.002-in. Lines on 0.004-in. Centers

Single-sided boards are held horizontally on Model 400 while etchant is sprayed vertically with compound



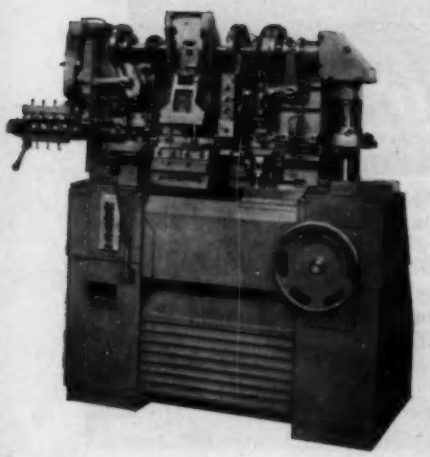


AT COLISEUM SHOW, these two machines were introduced. Latest model AL76-A Supermill horizontal boring, milling, drilling, and turning machine (above) has Airflo suspension system that eliminates metal-to-metal contact on table movement and complete pendant controls. New Morando Series PN heavy duty standard production lathe (below) comes in three models with swings of 34, 38, and 43 in. Each model has optional center distances ranging from 5—40 ft—*S & S Machinery Co, 140 53rd St, Brooklyn 32, N Y*

MORE DATA? Circle 74, inside back cover

THESE PARTS ARE BEING PRODUCED AT SPEEDS OF 90 TO 250 PCS/MIN

PROFIT-TREE!



These are formed parts produced in single automatic operations on the revolutionary new Torrington Vertical 4-Slide.

With precision and speed, the Verti-Slide has replaced as many as five and six progressively tooled presses in the production of a complex part. Normal secondary operations such as welding are being done in one continuous automatic operation in excess of 100 pcs/min.

If you make or buy complex wire or strip parts, the Verti-Slide method offers dramatic reductions in production cost. Less parts handling, in process inventory, machine space—all mean greater profits to you.

Write or call for field technical data or a Torrington Sales Engineer.

THE TORRINGTON MANUFACTURING COMPANY

MACHINE DIVISION Torrington, Connecticut

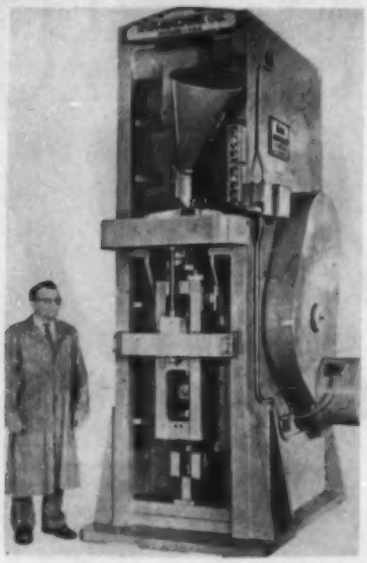
CIRCLE 239 READER SERVICE CARD

oscillatory motion. Line widths of 0.0005 in. have been etched in resolution tests; precision etching of lines 0.002 in. on 0.004-in. centers reportedly can be accomplished with ease.

Size of the machine is 47 x 29 x 47 in.; capacity is 37 gal. Board sizes are 20 x 30 in., adjustable rack. Controls are 15 minute electrical reset timer for etchant pump, thermostat for immersion heater. Power requirements are 220-v 60-c totally enclosed motor.

Centre Circuits Inc, PO Box 165, 1101 N Atherton St, State College, Pa

MORE DATA? Circle 84, inside back cover



125-Ton Compacting Press Does Automatic, Continuous Production

This 125-ton mechanical powder compacting press is designed for automatic and continuous production of solid compacts from dry powdered or granular materials under high pressures. The pressure can be applied with both upper and lower punches.

An unusual feature of this machine is its capacity to eject a compact at the full-rated pressure. Parts can be produced with depth of material fill up to 6 in. and up to 6 in. dia or length at the rate of 12 a min.

Kux Machine Co, 6725 N Ridge Ave, Chicago, Ill

MORE DATA? Circle 85, inside back cover

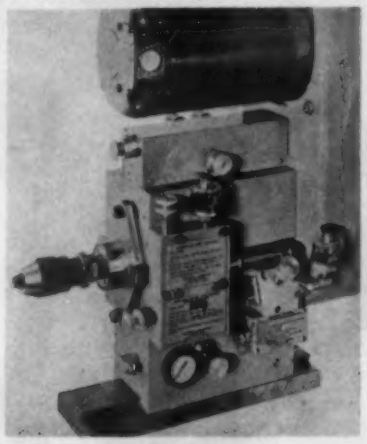
Maraglas Epoxy Cures Faster, Has Higher Impact Strength

Improved epoxy resin #655, with use of #555 hardner, can be cured as high as 180F with relatively small objects. Material reportedly cures to Rockwell hardness between 50-100M.

The transparent resin, which provides 90% light transmission, is used for making bubble-free castings without any need for vacuums or complex equipment. Manufacturer claims it is highly successful in making glass to glass bonds. Sample kit of resin, hardener, and accessories costs $6.

Marblette Corp, 37-31 30th St, Long Island City 1, N Y

MORE DATA? Circle 86, inside back cover



Automatic Drilling and Tapping Machine Has Speeds to 10,000 rpm

Single-spindle automatic unit for drilling, tapping, threading, nut tapping, reaming, and other secondary operations can be mounted at any angle or in any position desired. It has speeds from 500—10,000 rpm.

Maximum spindle stroke is 2½ in. and is adjustable down to ⅛ in. In mild steel, drilling capacity is 0.020—⅜ in., tapping capacity ⅜ in.

Complete unit includes hydraulic feed control, adjustable top dwell, fixture synchronizing stations, adjustable bottom dwell, and positive depth control. Clamping fixture air outlet, pressure regulator, and gage are also provided.

Universal-Automatic Corp, 9545 Ainslie St, Schiller Park, Ill

MORE DATA? Circle 87, inside back cover

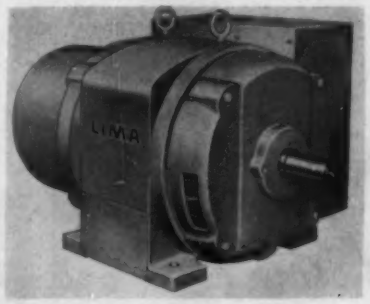
La Salle Has Stressproof Steel Bars in Diameters up to 4 Inches

Because of popular demand by current users, Stressproof steel bars are now available in diameters up to four inches. High strength—100,000 psi yield—without heat treating is maintained, and yet there is no time lost in sending parts to a commercial heat treater or the user's heat-treating department.

When it is used in place of most other steels of equivalent strength, Stressproof increases machining rates from 50—100%; it is rated at 83% of B1112, which is very good machinability for a steel of this strength.

La Salle Steel Co, P O Box 6800-A, Chicago 80, Ill

MORE DATA? Circle 88, inside back cover



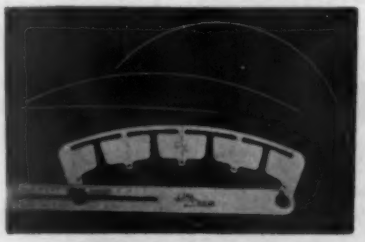
Lima Electric Offers Line of Special Application Generators

Precise Power ac generators and motor generators are available in ratings from 5 kw through 100 kw in open type construction with static exciter-regulators. Inherent regulation is to ±10%, or magnetic amplifier regulation to ±1%.

Special Brushless ac generators with dripproof construction are adaptable for engine mount or direct coupling to driving motor. Lima synchronous generators, rated from 5 kw at 1800 rpm through 100 kw at 1800 rpm are equipped with induction-exciter-regulators. Totally enclosed fan-cooled types are rated at 5 kw at 1800 rpm through 50 kw at 1800 rpm.

Lima Electric Motor Co, Dept 132, Lima, Ohio

MORE DATA? Circle 89, inside back cover



DRAFTSMAN'S TOOL, the Acu Arc ruler is used to draw arcs of circles of any radius from 7 in. to 200 in. or more, even if the center point of the circle is beyond the edge of the drawing board. Movable pointer on a scale reading in radius length gives the exact arc required—*Fullerton Engineering Sales Co, 4623 York Blvd, Los Angeles 41, Calif*

MORE DATA? Circle 90, inside back cover

ANOTHER 1ST FROM MILLERS FALLS

Watch Out... IT BITES!

Revolutionary new JET BAND Vanadium Carbide Bandsaw

Check these advantages:

- JET BAND outlasts . . . outperforms carbon bands 3 to 1 at regular speeds and feeds!
- JET BAND matches high speed steel band performance — yet costs 25% less!
- JET BAND steel is an entirely new alloy — specially developed for bandsaw use!
- JET BAND vanadium carbide is harder than a grinding wheel — twice as hard as carbon bands!
- JET BAND cuts even stainless and high temperature alloys *on standard machines!*
- JET BAND is thoroughly proved — backed by over a year of testing in the field!
- JET BAND has high fatigue resistance!

Write for full information

MILLERS FALLS COMPANY
Dept. AM-20, Greenfield, Mass.

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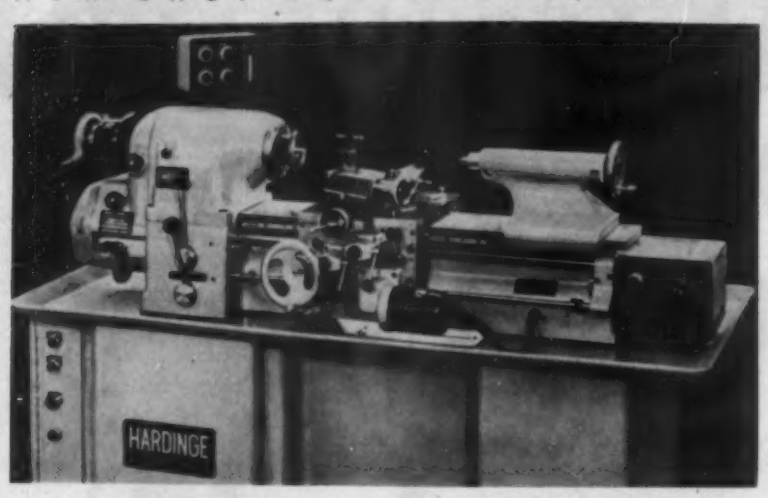
HAND TOOLS | PRECISION TOOLS | METAL CUTTING SAWS | ELECTRIC TOOLS



New Hardinge Lathe Designed to Fill Gap Between Precision and Heavy Duty Models

Model HLV-H high speed precision lathe has an 11-in. swing over the bed and infinitely variable speeds from 125—3000 rpm. This electrical drive is pushbutton controlled. Because of several new features, the lathe is said to fill the gap between the plain precision bench lathe and the heavy duty engine lathe.

Since it has a larger headstock frame and super-precision preloaded ball bearings, the lathe gives maximum precision for sustained operation even at full speed. The headstock spindle has a through collet capacity of 1 1/16 in. and a step chuck capacity of 6 in.

Standard equipment on the new lathe includes a built-in automatic thread control and a quick-acting compound slide for threading. Since a separate electric motor provides the feed for carriage and cross slide, the lead screw is used for threading only; therefore, maximum accuracy is sustained for precision threading operations. The power feed is entirely separate and used for feeding only.

In addition to the above lathe, Hardinge has also brought out a new model TFB high speed precision turning, facing, and boring lathe. This machine is the same as the tool room lathe except for the gear box, lead screw, and other items related to threading.

Hardinge Brothers, Inc, Elmira, N.Y.

MORE DATA? Circle 75, inside back cover

Remote-Controlled Electron Gun Makes Coatings at Higher Rates

A new remote-controlled electron beam evaporating unit capable of vaporizing all metals, ceramics, refractory compounds, and other nonmetallics is available as a standard product. Model EBV-4 is a remote-controlled electron beam gun that is suitable for installation in almost any laboratory or commercial vacuum equipment operating at 3×10^{-4} mm of Hg or lower.

It may be used for either research and development or volume production of thin film coatings for microminiaturized electronic circuitry, optical filter films, and similar applications. The EBV-4 offers not only the advantage of higher deposition rates than other models, but also makes available for the first time equipment capable of vaporizing and depositing ceramics, and other nonmetallic materials.

Price of the standard unit is $15,750, including field engineering service to assist in installation and demonstration of proper operation.

The Alloyd Corp, 35 Cambridge Pkwy, Cambridge 42, Mass

MORE DATA? Circle 77, inside back cover

High-Speed Gun Drill Attaches To No. 5 Lathes or Larger

The new model 5-100 series gun driller fits, without an adapter, No. 5 or larger ram-type turret lathes. With an adapter, the unit fits saddle-type lathes. Gun drill sizes 3/16—⅝ in. fit the ¾-in. spindle bore, and twist drills—with or without oil holes—may also be used in this attachment by adapting their shanks to its ¾-in. spindle bore.

Since the model, which is driven by a 1½ hp motor, has 4 spindle speeds—1748, 2450, 3345, and 4600 rpm—it is suited to practically all gun drilling applications. A high speed version, offering speeds to 6000 rpm, is also available.

The gun driller mounts right on the turret face and has a quick-disconnect coupling on the coolant line which permits turret rotation.

The Ward-Riddle Co, 241 Myrtle St, Ravenna, Ohio

MORE DATA? Circle 76, inside back cover

New Northern Portable Hardness Tester Reads Direct to ½ Point

This new portable hardness tester, which weighs only 6½ lb, gives direct readings of Rockwell hardness to ± ½ point. Two units, the Regular Model 3R and Superficial Model 3S, have 3-in. vertical capacity and 3-in. horizontal reach.

Model 3R gives direct readings on C, A, B, and E scales; model 3S on the T and N scales. All other scales are covered by a transposing chart.

STEELWELD BRAKE
AIDS PASCOE BUILDING PRODUCTION

This powerful Steelweld Press Brake has proven itself to Pascoe. It performs a huge volume of bends.

Shown below is a stack of eave struts produced on the Steelweld Brake. These are 20'-0" long and of 10 gage steel.

AN important manufacturer of prefabricated steel buildings on the West Coast, the Pascoe Steel Corporation, Pomona, California, keeps their Steelweld Press Brake going full tilt in order to keep up with the production schedule.

The brake normally handles steel up to 20'-0" x 3/16", although occasionally 1/4" metal is formed. It has the speed and power to produce sharp accurate bends at a fast rate.

Despite all the work put through, only the meagerest amount of maintenance is required. For instance, the clutch has had to be adjusted only once, every eight-month period and this can be done in very few minutes.

Pascoe builds a complete line of pre-engineered buildings which are used for warehouses, light manufacturing, grain storage, auditoriums, aircraft hangers, etc.

Write for free copy of catalog No. 2023A

STEELWELD

Mechanical and Hydraulic

PRESS BRAKES

Steelweld Machinery includes: Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION, THE CLEVELAND CRANE & ENGINEERING COMPANY • 1473 E. 281st ST. • WICKLIFFE, OHIO

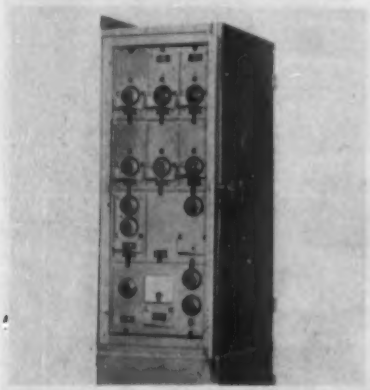
On either instrument, the operator simply sets an indicator pointer at the desired scale and makes a final adjustment with test blocks. These testers have no weights which can be confused or misplaced.

Model 3R testers are built with major loads of 150, 100, and 60 kg; model 3S units have lower load factors of 45, 30, and 15 kg, since indentation of the penetrator is considerably less than in normal testing. These 3S models, therefore, are specially adapted for testing products not suited to deep penetration, such as thin strip metals, light carborized steel, fine tools such as ring and plug gages, and for testing close to the cutting edge of dies.

Also available are new Regular Model 9R and Superficial Model 9S, with 10¼-in. vertical capacity and 5-in. horizontal reach. These testers, although they weigh 48 lb, are portable also, and have been designed for convenient testing of both large and small parts.

Northern Mfg & Engng Co, 2500 N Main St, Rockford, Ill

MORE DATA? Circle 78, inside back cover



GE Resistance Welding Control Has Ignitron Misfire Detector

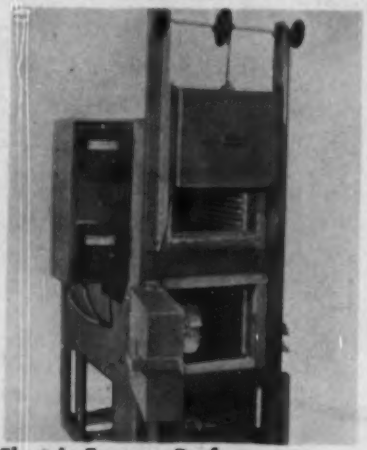
A misfire detector for resistance welding control equipment is designed so that any misfire of the control's ignitron contactors, which operate on alternate half-cycles to switch current into the welding transformer primary, trips a relay and gives an indication to the operator.

Should one tube fail to fire, the welder skips and the second tube fires twice in succession. This may saturate the transformer and raise exciting current to a high value that could damage the other ignitron. The detector gives an instant indication of improper welds, useful in automatic seam-welding of materials with a narrow plastic temperature range. It helps to prevent overloading an ignitron and indicates when tubes need replacement.

The detector may be used to operate a signal light or horn, counter, marking device, reject mechanism, shutdown circuit, or any combination of these. It is designed to plug into an existing control panel and can be supplied with or without an enclosure for panel or wall mounting.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 79, inside back cover



Electric Furnace Performs Complete Heat Treating Job

Series 8012 electric heat treating furnace, latest addition to the Lucifer line, comprises two furnaces in the floor space of one. Complete heat treating application can be performed with this unit — hardening in the high temperature furnace, drawing in the low temperature, and quenching in the roll-away quench tank. High-temperature chamber operates to 2300 F and the low temperature chamber to 1250 F. Ten standard sizes are available in the series.

Lucifer Furnaces Inc, Neshaminy, Pa

MORE DATA? Circle 80, inside back cover

Carbide Center Drill-Countersink Available in Six Sizes

Solid carbide combined center drill and countersink, part of Dixie's 710-A series, is specially designed to operate and cut in extremely hard metals where normal high-speed tools will not be effective. It can also be used for highly abrasive applications where other tools will not last out a long production run. Tool has a double end, 60° included angle and RH cutting.

Dixie Tool Industries Inc, Bridgeport, Mich

MORE DATA? Circle 81, inside back cover

Open Die Cold Heading Machine Has 2 Sets of Straightening Rolls

An improved open die precision cold heading machine for making long, thin parts such as lead wires, pins, or rivets is a full 50% heavier than the model it replaces. Production rates run as high as 110 pieces a min on parts up to 2⅜-in. long with a nominal wire capacity of 0.020—0.090-in. dia.

The machine is furnished with two sets of straightening rolls: a roll straightener for fine wire up to 0.036 in. and an auxiliary 5 roll straightener for wire sizes of 0.036—0.090 in. A one-shot lubrication system and a set of prototype tools are standard equipment.

REM Sales, Inc, Sub of Robert E Morris Co, Box 41, West Hartford, Conn

MORE DATA? Circle 82, inside back cover

TYPE BAC-12M humpback conveyor furnace does controlled brazing on a new semiconductor product. Operating temperatures of 2050 F are held within extremely critical tolerances while brazing under hydrogen atmosphere—C I Hayes, Inc, 810 Wellington Ave, Cranston, R I

MORE DATA? Circle 83, inside back cover

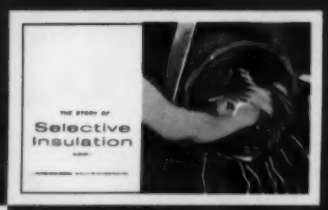
CIRCLE 242 READER SERVICE CARD ►

Unmasked...

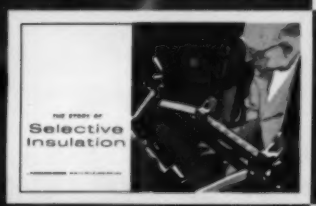
the true story of motor insulation

The selection of insulation materials—and the methods of their application—are basic factors in the performance of every electric motor. Yet their true significance has escaped many motor buyers . . . hidden by a mask of tricky trade names and claims for "cure all" insulations that simply do not exist.

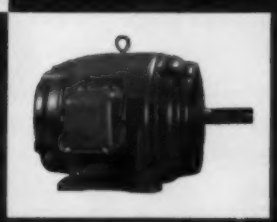
To help any motor buyer become a wiser buyer, Fairbanks-Morse has prepared these two new brochures. They separate the facts from the fiction about insulation systems. They are based upon the authority of long years of proved practices. Yours for the asking . . . write: Electrical Division, Fairbanks, Morse & Co., Freeport, Illinois.



"PROCESS AND MATERIALS"



"SELECTION AND APPLICATION"



FAIRBANKS-MORSE ELECTRIC MOTORS
FROM ½ TO 10,000 HP.

Fairbanks, Morse

ELECTRICAL DIVISION

A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**

AIR EXPRESS speeds newly created parts to assembly site in time for car to bow at international auto show

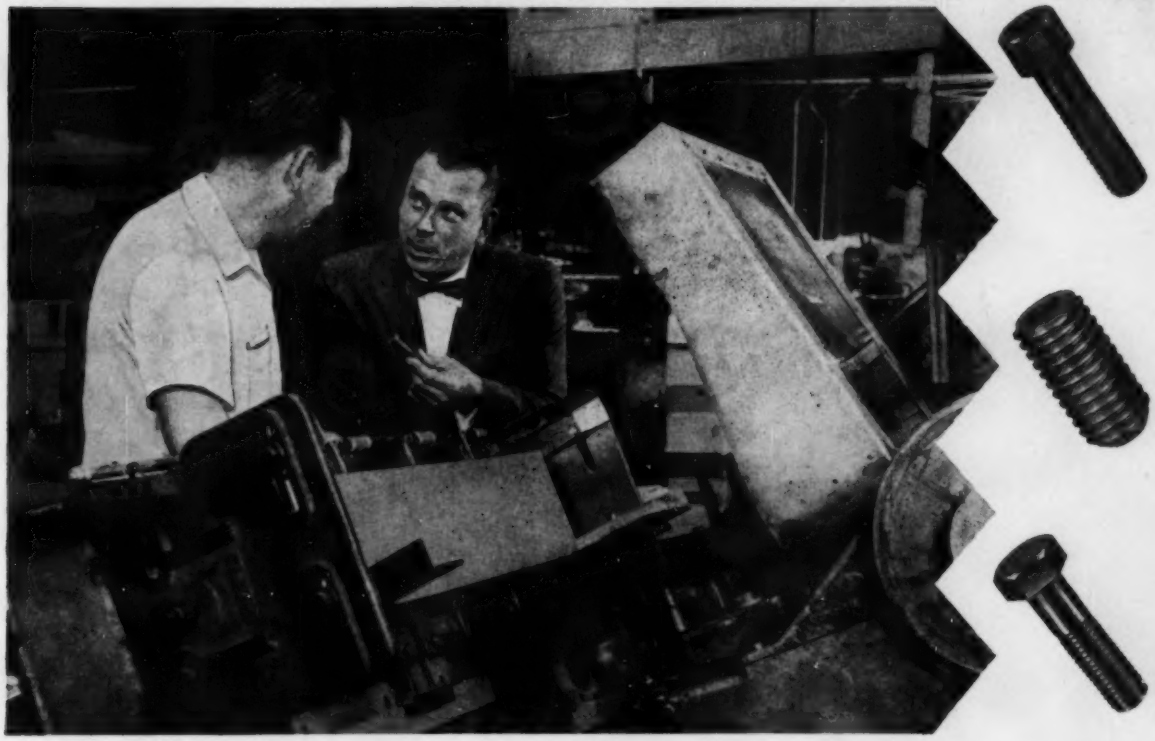
Air Express takes priority on all scheduled U. S. airlines

AIR EXPRESS is in the auto business, now! This crew is just finishing off the latest model. Hours from now, it will bow at a glamorous auto show. Many new parts were completed just in time, and flown to this assembly point with jet speed. All 35 scheduled U.S. airlines pampered them with priority treatment. AIR EXPRESS trucks (13,000 . . . many radio-dispatched) rushed them door-to-door at both ends of their flights. As each part arrived, the shipper got a teletype receipt. That's service! AIR EXPRESS is in other businesses, too. It should be in yours. There's no finer partner and rates are low. One phone call is all it takes.

AIR EXPRESS

CALL AIR EXPRESS DIVISION OF RAILWAY EXPRESS AGENCY • GETS THERE FIRST VIA U. S. SCHEDULED AIRLINES

IT PAYS TO STANDARDIZE ON STANSCREW



Stanscrew solves production problem, saves money for *Ball* closures

The specialized machines which every day turn out millions of jar tops, bottle caps, and other closures for Ball Brothers Company, Inc. must work to a very tight production schedule. Fastener failures in this equipment can be extremely costly.

One particular application was a real headache. Even specially designed fasteners failed time and time again. Ball's distributor then called in the Stanscrew fastener specialist. His recommendations included minor redesign, the use of a particular standard fastener from Stanscrew's complete selection, and detailed instructions on its application. This eliminated many production interruptions for Ball . . . for important savings.

Whether you need fasteners for the maintenance of important production machinery or as components of your finished product, you can often save money by standardizing on Stanscrew . . . as more and more industrial leaders are learning. Stanscrew offers a complete stock of 5,500 different standard fasteners . . . produced to the highest quality standards made possible by American technology . . . to provide economical answers for the overwhelming majority of all industrial fastener requirements.

The suggestions and technical assistance of the Stanscrew fastener specialist may result in significant savings in your assembly and maintenance costs. Your local Stanscrew distributor will be happy to arrange a prompt visit. Call him today.

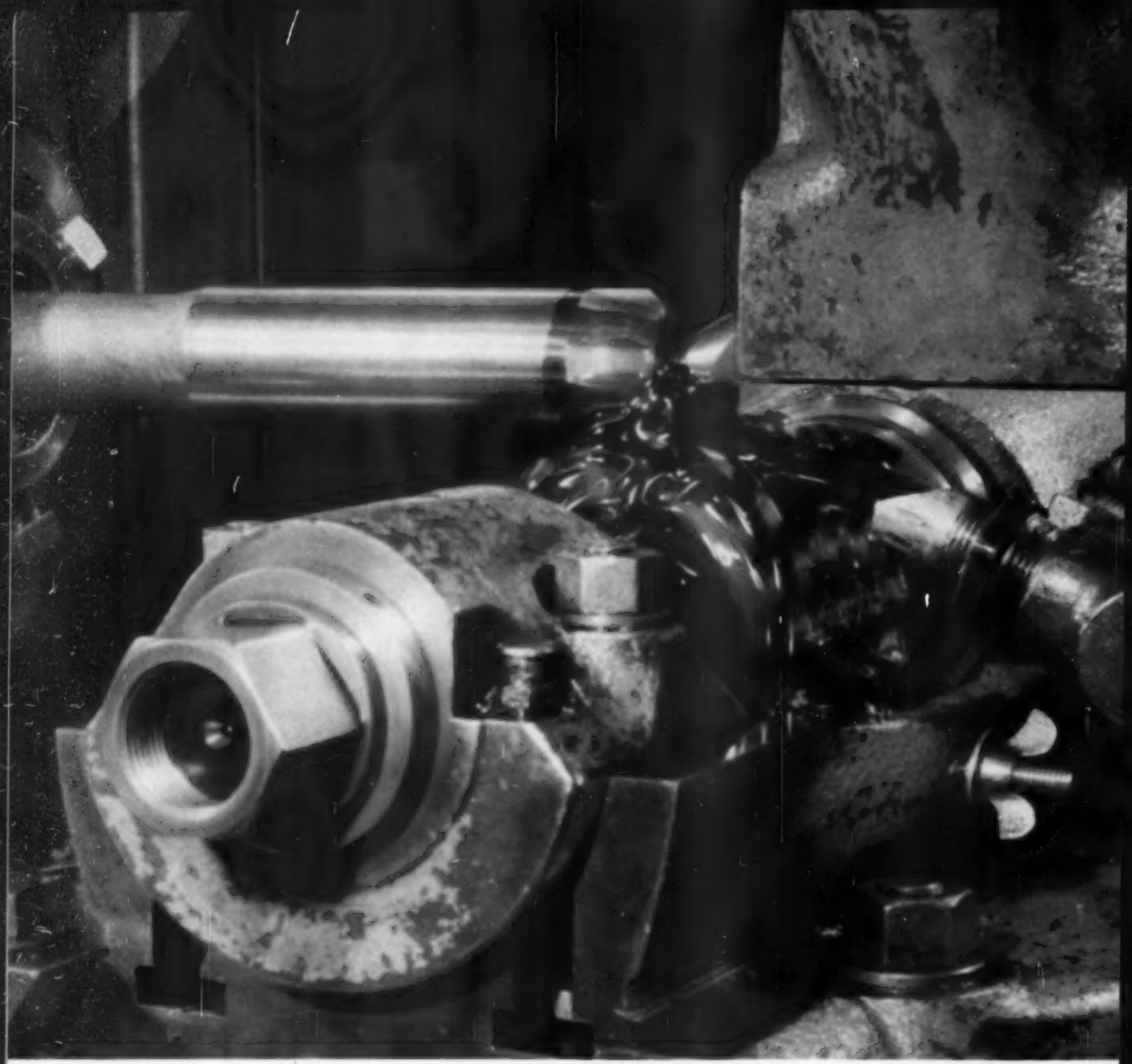
STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

CIRCLE 244 READER SERVICE CARD

CIRCLE 245 READER SERVICE CARD ►



Baker Industrial Trucks switches to Gulfcut® 21C

GULF MAKES THINGS

After a series of comparative cutting oil tests, Otis Elevator Company, Baker Industrial Trucks Division, Cleveland, switched to Gulfcut 21C oil for hobbing their spline shafts, gears, axles, and other drive components. Here's why.

"Tests were carried out under actual work conditions," explains Plant General Manager Eugene Caldwell. "In one test, the workpiece was a 42-tooth spur gear forging of SAE 4142 steel, heat treated to Rc 20-27 hardness and cut on a Barber-Colman gear hobber. The oil we had been using gave us 10 to 12 pieces per hob shift. With Gulfcut 21C, we got 22 pieces.

"In another test, we hobbed Rc 23-34 steel spur gears on a Fellows machine. With our old cutting oil, we used to finish 10 to 12 gears per hob shift. With Gulfcut 21C we finished 20 pieces before regrinding."

Other production tests resulted in similar improvements. Says Mr. Caldwell: "By switching to Gulfcut 21C oil for these applications we've doubled tool life while maintaining close tolerances and fine finishes."

Mr. E. Caldwell, Plant Manager for Otis Elevator Company, Baker Industrial Trucks Division, Cleveland, explains Baker quality points to Thomas F. Irving, Gulf Sales Engineer.

Splines being cut for a Baker lift truck axle. Cutting oil is Gulfcut 21C.

oil, doubles tool life . . .

RUN BETTER!

Gulfcut 21C is a sulfurized mineral oil. Its transparent light color permits close observation of the workpiece. It stands up well under tough machining conditions because it provides greater sulfur activity over the entire range of the cutting operation.

See for yourself how Gulf makes things run better! Call your Gulf Sales Engineer at your nearest Gulf office. It's his business to help. Meanwhile, write for your free copy of "Metal Machining with Cutting Fluids," the new 116-page handbook on their selection and use.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Houston 1, Texas

GULF

SF-9865

Reuland motor-and-magnetic-brake package

...complete from one dependable source!

Reuland manufactures its own magnetic brakes, as well as electric motors, and offers the most versatile selection of tailored-to-your-equipment *brakemotor* packages available anywhere. Reuland's many hundreds of combinations of H.P., speed, special drive motors and brake sizes, provide an almost unlimited coverage of O.E.M. and user requirements!

So, whatever your *brakemotor* needs may be, standard or special, let Reuland supply the complete answer in one, compact, smartly-designed power package. One source of supply for brake and motor saves time for your Engineering and Purchasing Departments... one nameplate establishes dependable, nationwide service responsibility!

Refer to Sweet's Product Design, Section 5-a

BRAKES AVAILABLE IN ALL 3 MOUNTINGS... FULFILLS J.I.C. SPECIFICATIONS!

1. Direct endbell type for mounting over motor's shaft.
2. Foot mounted, for mounting over existing shaft.
3. Foot mounted—complete with own bearings and shaft.

- Automatic Lining Wear Adjustment
- Manual Release—Automatic Reset
- Mount in any position
- No Levers or Linkage
- One-Piece Housing
- One-Half Conventional Length
- Wide Range of Ratings

Our new 8-page catalog, No. GS8-30-0, will come in handy. Sent complete with prices and engineering drawings on request.

MODERN POWER FOR MODERN-DAY PRODUCTS

... all in lightweight, cool-running aluminum frames!

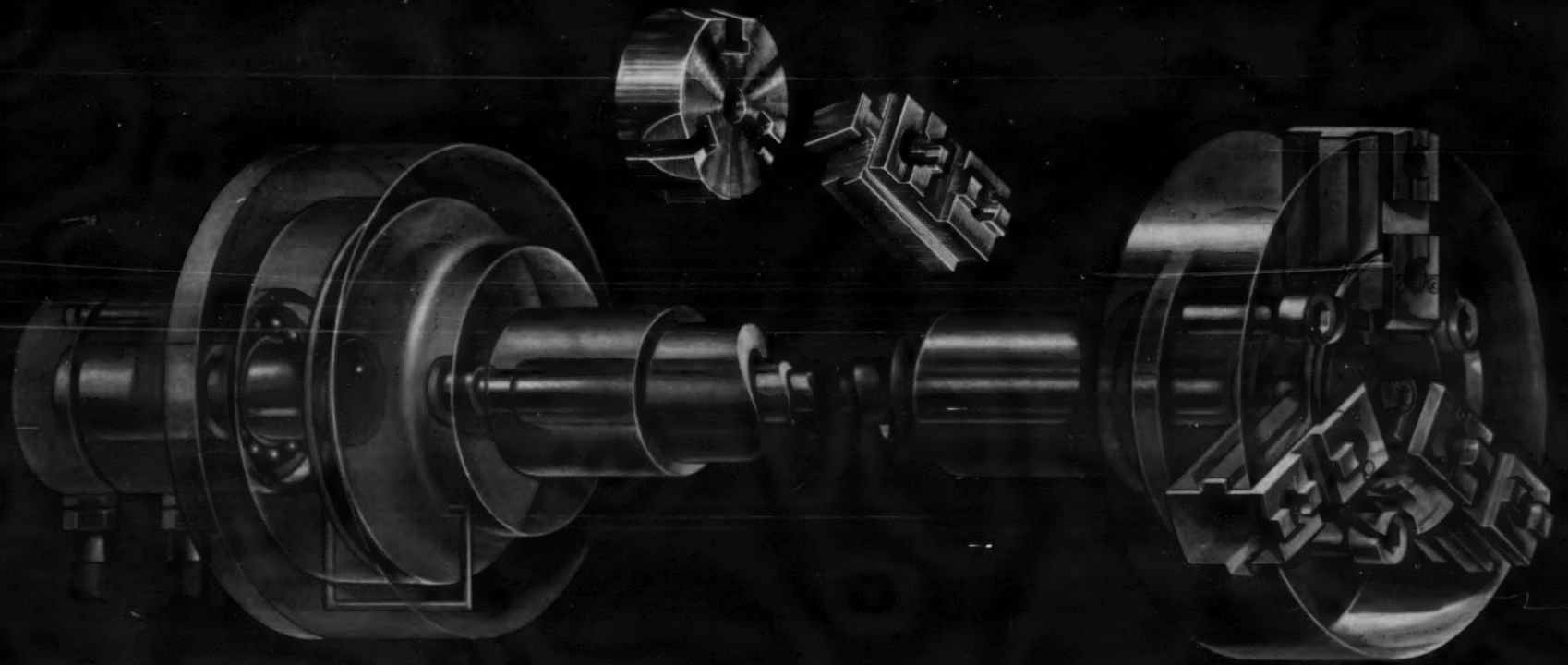
REULAND MOTORS

REULAND ELECTRIC COMPANY
WESTERN DIVISION: *Alhambra, Calif.*
EASTERN DIVISION: *Howell, Mich.*
Distributors in all principal cities

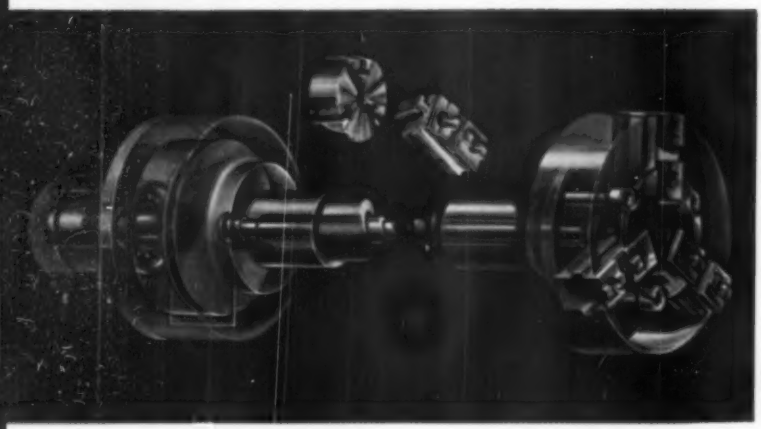
CIRCLE 247 READER SERVICE CARD

CIRCLE 248 READER SERVICE CARD ►

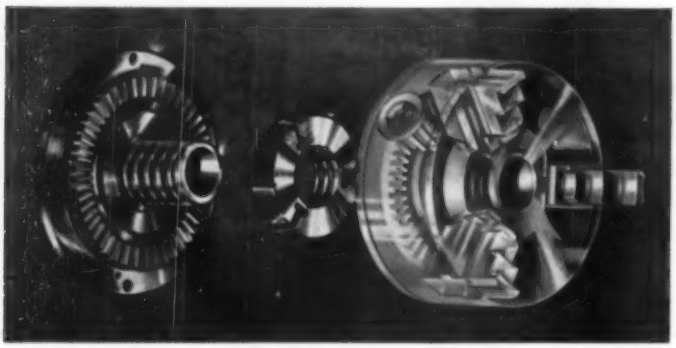
SKINNER PACKAGED POWER CHUCKING ASSEMBLY



Typical major chuck developments that come to you from SKINNER



Packaged power chucking assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar and drawtube, rotating air cylinder, cylinder adaptor and necessary mounting for the individual machine.



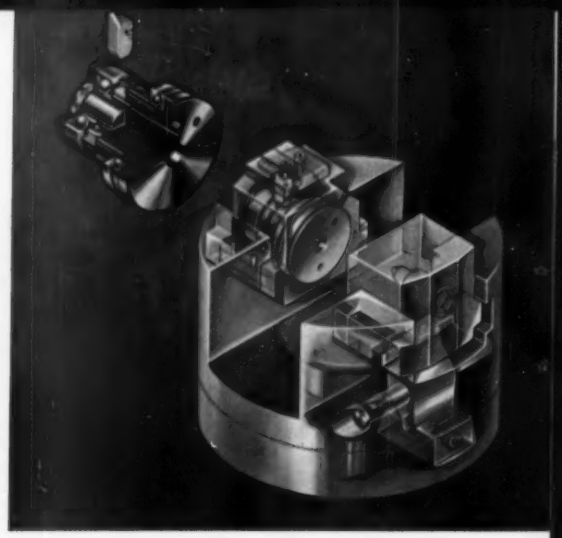
Extra-heavy-duty Wedge-Screw chuck combines best features of power and hand chucks. It develops tremendous gripping power, high accuracy and repeatability by a unique principle. When the lug-type pinion is turned manually or by a power wrench, it engages the gear plate causing the screw to move the wedge. The force of the wedge on the jaws holds the work with tremendous power.

This Wedge-Screw chuck has such useful features as:

Accuracy—within .001 total indicator reading
Repeatability—within .0005 total indicator reading
Complete Range—no size limitation

Many other features including over-tightening and operator protection, sealed operating mechanism, automatic lubrication, etc.

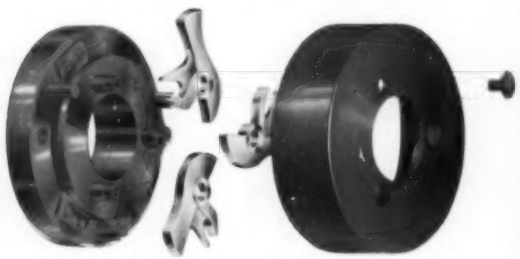
For complete details about packaged power chucking assemblies, indexing chucks, wedge-screw chucks, +GF+ Work Drivers, other chucks and chuck equipment, contact your Skinner Representative or Distributor, or write us at the address below.



Heavy-duty power chuck with jaws that index freely under full pressure. Indexing is simple, easy, and fast. The operator can index manually without touching the work or releasing the pressure. Jaws are indexed by means of a lock screw and slide plate. Note the size and shape of the indexing pin. It fits firmly and positively into the indexing plate so that extreme accuracy of indexing is assured.

One or both jaws can be furnished with indexing mechanisms. As a result, you can index more positions and smaller index angles. There is no need to buy a new chuck for different indexing positions because index jaws or index components can be interchanged quickly and easily.

This new Skinner chuck is available in all body diameters from 12″ through 36″.



+GF+ Work Drivers distributed by Skinner, are the best clamping devices available for driving rough or smooth blanks between centers. Eccentric jaws with floating spring action hold firm, and any increase in cutting tool pressure and/or spindle speed automatically increases the holding power of the work driver. The jaws are easily reversed to accommodate changed direction of spindle rotation.

The protective hood covers all mechanism and provides means of manually opening and closing jaws. A slight turn of the hood, with surface cross-hatched for sure grip, opens jaws and holds them open until work is placed between centers—another turn releases jaws to grip work. **+GF+** Work Drivers are available to hold work ranging in diameter from $1\frac{1}{32}$″ to $8\frac{1}{16}$″.

Maximum eccentricity of any piece is $\frac{5}{32}$″. Finished adaptor plates or rough castings are available for mounting on all types of machines.

See these Skinner products at the Production Engineering Show Booths 212 & 214.

SKINNER CHUCKS®

THE CREST OF QUALITY

SKINNERCHUCKS

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U. S. A.

PRINTED IN U.S.A.

How Protection Program of Control Instrument Co.

CONTROLS COSTLY EYE ACCIDENTS

Eye injuries are far fewer and much less severe . . . lost production time plus medical costs *drop* from $5.17* per year per employee to $.56* — that's the experience of Control Instrument Co., Brooklyn, N. Y., subsidiary of the Burroughs Corporation, since installing an Eye Protection Program in June 1956.

Lost production time per employee per year down from 1.67 hours* to 1/10th of an hour; lost production hours in dollars down from $3.36* per employee to $.23* — these are significant savings.**

When *you* install an eye protection program, be sure to go *all the way* with *quality* equipment. American Optical Company can supply the *right* glasses or goggles, in the *right* frames for the man and the job. Write us or phone your nearest AO Safety Representative.

*Estimated

**Savings would be considerably higher if savings in compensation costs were included.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

Always insist on Trademarked Lenses and Frames

SOUTHBRIDGE, MASSACHUSETTS • *Branches in Principal Cities*

Device Taps All Standard Threads Without Changing Lead Screw ▶

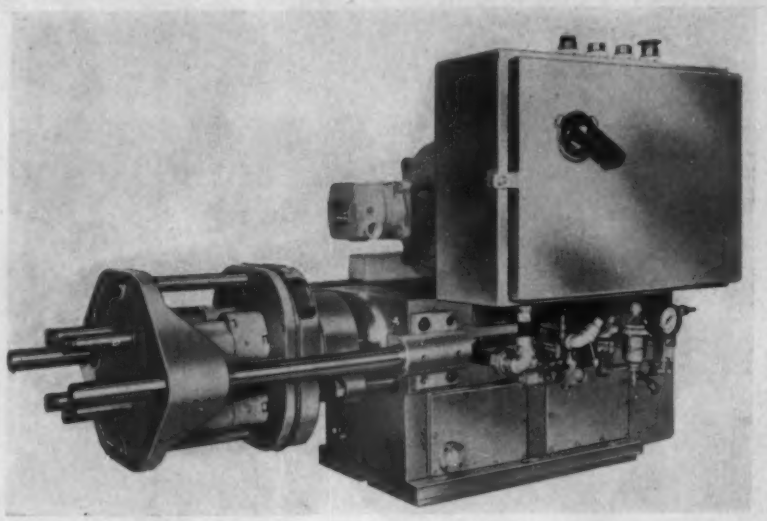
This new tapper adapts the lead screw principle—so long basic to the engine lathe — to give accurate threads and pitch change with one lead screw. Tapping pitch is changed by changing only one gear at the back of the unit, and can be done in less than 10 min.

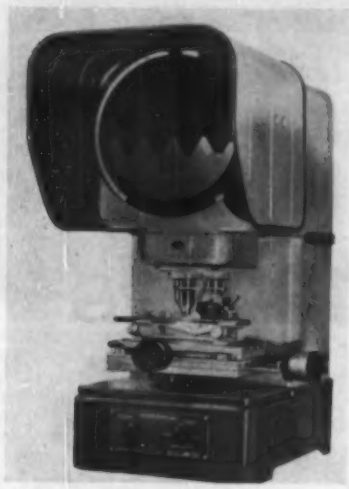
The unit is completely self-contained and may be mounted in any position from vertical to horizontal; an oil pump provides circulating oil lubrication to all bearings and gears. All rotating parts are mounted on ball bearings, and the guide rods operate in ball bushings instead of sleeve-type bearings.

Maximum stroke is 5 in. with 3-in. rapid approach and 2-in. lead screw travel. All movements are adjustable and may be correlated for automatic operation. Model illustrated has a 4-spindle double eccentric adjustable tapping head attached.

Thriftmaster Products Corp, 1048 N Plum St, Lancaster, Pa

MORE DATA? Circle 91, inside back cover





Nikon Introduces New Line Of Optical Comparators

Three models in this new line of optical comparators (Bench Model VI shown above) all have a 12-in. ground glass screen with cross-hairs and are equipped with a three lens turret which holds Nikkor optics.

Model II, which is a bench unit, is portable and has magnification ranges of 20 and 50X. By making use of either surface or shadow lighting, it gives illumination that is sufficient for on-the-spot inspections and measurements even in a normally lit room. Price is $645.

Model III—and the bench Model VI which has the same basic features — has a magnification range from 10—100X, with provision for simultaneous surface and contour inspection. These two models accommodate a wide variety of stages, fixtures, lenses, and other accessories which equip them for virtually every application of accurate inspection and observation of precision parts. Model II sells for $1850; Model VI for $1275.

Nikon Inc, 111 Fifth Ave, New York 3, N Y

MORE DATA? Circle 92, inside back cover

New Alloy Steel Bandsaw Blade Introduced by American Saw

Lenox Master-Band, reported to outlast from four to eight regular metal-cutting bands, can be used on either standard equipment or automatic cutoff machines. It is said to be capable of producing at a faster cutting rate than regular blades and to be highly effective on tough alloy steels; it will give a straight-line cut on tough steels that other blades are unable to cut.

Special steel analysis produces a greater quantity of carbides in the metal structure.

American Saw & Mfg Co, Springfield, Mass

MORE DATA? Circle 93, inside back cover

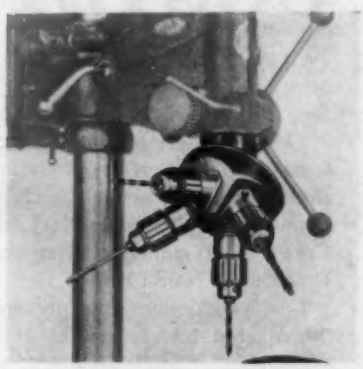
Du Pont Thermoplastic Piping Protects Polished Machine Parts

Vexar plastic piping, extruded directly in tubular form by a patented British process, retains chemical and physical characteristics of polyethylene. This semi-rigid material, available in a variety of colors, is useful as a protective sleeve over highly polished tubular machine parts, such as bearing shafts.

The slight elasticity of the tubes allows a major simplification in inventory problems, because a manufacturer who would have maintained a stock of several hundred different diameter paper tubes can substitute three sizes of Vexar. Price is $1.50 per pound in tubular form, or in a sheeting form for polyethylene netting.

E I duPont de Nemours & Co, Wilmington, Del

MORE DATA? Circle 94, inside back cover



QUADRILL SPINDLE ASSEMBLY quickly converts practically any drill press into a precision turret drilling machine for very little cost. Each spindle is mounted on two preloaded ball bearings featuring zero clearances for greater rigidity, accuracy, and longer life—*Chicago Quadrill Co, 1846 Busse Hwy, Des Plaines, Ill*

MORE DATA? Circle 95, inside back cover

Mrs. Florence Smith, operator of the Federal Products Corporation, achieves ultra-precise results with the No. 3 Moore Jig Grinder.

Woman operator at Federal Products maintains 50 millionths accuracy with No. 3 Moore Jig Grinder

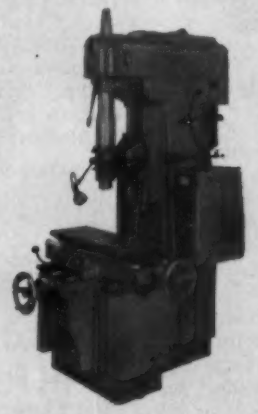
Moore Special Tool Company numbers among its long-time customers the Federal Products Corporation of Providence, Rhode Island—a leading manufacturer of dial indicating, air, electric or electronic gages—special equipment used for measuring, inspecting, sorting or automatic gaging.

The type of work produced by Federal Products calls for highly skilled personnel, not the least talented of which is a woman jig grinder operator, Mrs. Florence Smith.

Mrs. Smith has a *natural* mechanical ability. She is Federal-trained, starting in their plant during World War II. Most of her work is producing masters for precision gages with small holes and slots. Her work is extremely accurate—and she keeps complete records of work performance. She is able to maintain accuracy to within 50 millionths...using the No. 3 Moore Jig Grinder.

Moore machines have been dependable performers in Federal Products Corporation's precision grinding room for a number of years. The company also uses other Moore equipment, such as the Moore Precision Rotary Table and Moore accessories...all of which help Federal meet their customers strictest requirements.

Write today for literature describing all the advantages of the No. 3 Moore Jig Borers and Jig Grinders.



Partner in Precision: No. 3 Moore Jig Borer

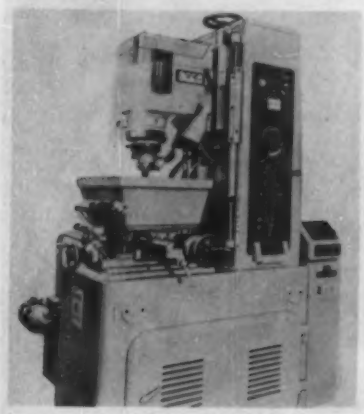
This new Moore Jig Borer is unequalled for the speed and accuracy with which it bores, drills, reams and spots holes in dies, jigs and production parts. It breaks the "tenth barrier." It offers more precise positioning tolerances...improved drive ...wider speed range, 60 to 2250 RPM...larger table working surface, 11 x 24".

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Conn.

HOLES, CONTOURS AND SURFACES. Tells how to produce tools and dies the modern way. 424 pages, 495 illustrations. $5 in U.S.A. $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

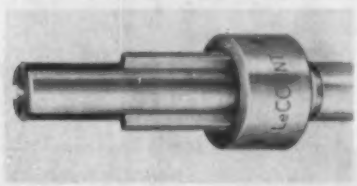


Electrical Discharge Machines Offered in Automatic Models

The Eleroda D1 and Eleroda D15 are made by Charmilles Engineering Works Ltd, Geneva, Switzerland and New York. Features of the D1 include magnetic electrode holder for working and locating within ± 0.0002 in.; hydraulic servo; table with jig borer accuracy; extremely stable electrical power unit (no tubes); 10 micro-in. surface finish guaranteed; heavily ribbed castings used throughout; fully automatic.

Dist by Charmilles Engineering Works Ltd, 25-20 43rd Ave, Long Island City 1, NY

MORE DATA? Circle 96, inside back cover



Series of Compact Mandrels Added to LeCount Line

Compact Series are more economical than the standard models because they are shorter and lighter but have the same wide expansion as the company's Type B long straight jaw mandrels. They are offered in Type C 0.0005-in. TIR, Type SC 0.0002-in. TIR, and Type CMC 0.0001-in. TIR. Line consists of 14 mandrels ranging from ⅜ to 3¼ in. and with jaw bearings from 1 in. on the smallest to 2½ in. on the largest.

LeCount Tool Works Inc, 38 Cody St, West Hartford 10, Conn

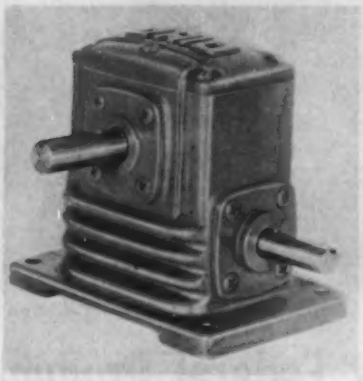
MORE DATA? Circle 97, inside back cover

Honing Stone Selection Kit Covers ⅛ to 2⅝-in.-Dia. Range

LN-610 kit contains stones for bore sizing and finishing requirements in the ⅛ to 2⅝-in.-dia range. Supplied in a steel cabinet with plastic drawers, assortment provides 224 stones in 72 varieties of abrasives and stone sizes, all separated in drawer compartments. Selection guides on drawer fronts identify contents; all stones are code numbered for positive identification. Top drawer is designed for utility use and storage of accessories.

Sunnen Products Co, Dept F-4, 7910 Manchester Ave, St Louis 17, Mo

MORE DATA? Circle 98, inside back cover



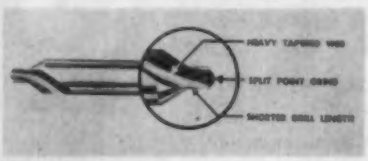
Higher Capacity Possible with Ventilated Gear Speed Reducer

A fin and fan cooled gear speed reducer is reported to be capable of delivering up to 80% more capacity than comparable non-ventilated models. It employs a worm and gear reduction and is designed for horizontal right angle drive.

Designated the Series S-13, it is available in a complete range of sizes from 1.33—5.25 in. center distance. Horsepower ratings range from 1/16 —18 hp.

Ohio Gear Co, 1333 E 179 St, Cleveland 10, Ohio

MORE DATA? Circle 99, inside back cover



Combined Drill and Countersinks Feature Low Point Breakage

New heavy duty line is designed with heavy tapered web and shorter drill length that add extra strength to the drill section to minimize point breakage. With the split point grind, the drill point begins cutting immediately on contact with the work. The drill will not crawl or wander when feed pressure is built up, resulting in greater accuracy in location of center hole. Considerably less thrust pressure is required to penetrate the work which also helps to minimize point breakage. Tools are stocked in both plain and Bell style.

Q-T Tool Co, 1000 R St, Bedford, Ind

MORE DATA? Circle 100, inside back cover

Miniaturized Synchronous Motor Has Direct Electrical Control

Haydon's series 42100, 60 cycle ac timing motor is said to be the shortest available. No longer than a cigarette filter—only ⅞ in.—it supplies speeds from 300 rpm to 1/6 rph through a ⅜ in. long shaft ⅛ in. in diameter. Rotation direction is controlled by electricity alone.

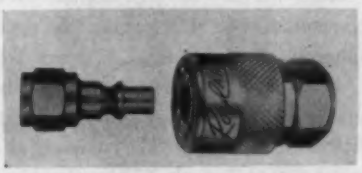
An additional feature is its fast starting and stopping, in many applications, without clutching and prestarting. Input is stated as 2.5 ma; maximum temperature rise is only 40C.

The standard gear train has brass wheels with steel pinions; an optional hard steel train will carry three times the normal load. Typical applications include relays, time indicators, commercial programming and many types of control equipment.

The motor is available in voltages ranging from 6—230 V at a 20 ma maximum.

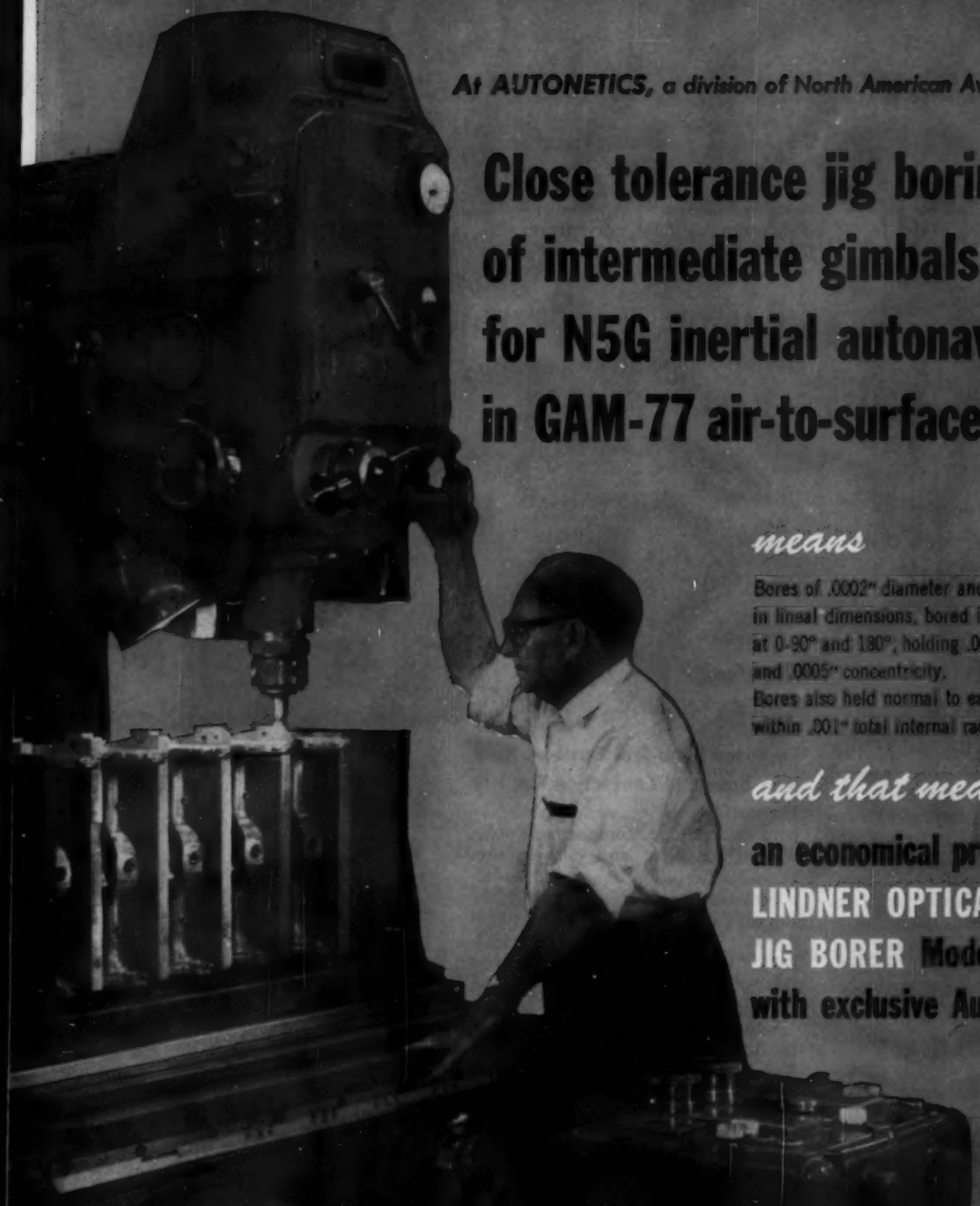
A W Haydon Co, Waterbury Conn

MORE DATA? Circle 101, inside back cover



COUPLINGS, Roylair quick connect series available in ¼ and ⅜-in. sizes, feature maximum flow and minimum pressure drop; self-sealing 360° swivel action; retractable sleeves; and high interchangeability with similar couplings — *Airaterra, 620 Paula Ave, Glendale 1, Calif*

MORE DATA? Circle 102, inside back cover



At AUTONETICS, a division of North American Aviation, Inc. . . .

Close tolerance jig boring of intermediate gimbals for N5G inertial autonavigators in GAM-77 air-to-surface missiles...

means

Bores of .0002" diameter and within .0005" in lineal dimensions, bored in three locations at 0-90° and 180°, holding .0005" parallel and .0005" concentricity.
Bores also held normal to each other within .001" total internal radius.

and that means...

an economical production run on LINDNER OPTICAL MEASURING JIG BORER Model LB15 with exclusive Autopositioner

Your close tolerance jig boring belongs on a LINDNER, too. May we show you all the reasons why?

KO PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

14 Exchange Place, Jersey City 2, New Jersey

Midget Tapper, for Small Drill Presses, Taps 10/32-in. Steel

Only 1 9/16-in. in diameter, this Midget tapper—which was designed for use with small drill units or drill presses—will handle taps up to 10/32-in. in steel. With its pressure-sensitive adaptation of a spring clutch drive, it transmits torque in proportion to the pressure applied.

The operator controls tapping torque with finger pressure on the drill press handle; therefore, he can feel the tap through the work and take action should the tap become loaded, hit a hard spot, or bottom.

The Midget is equipped with the Jacobs rubber-flex collet, and is available with No. 1 or 2 Morse taper shank, as well as a ½-in. straight.

Commander Mfg Co, 4225 W Kinzie St, Chicago 24, Ill

MORE DATA? Circle 103, inside back cover

Horizontal DC Rectifier Welder Offered in Two Models

The Silver Star reportedly has all of the durability and performance characteristics of the SRH All-Weather model; it is designed, however, for indoor use and the savings realized in its not being weather-proofed can be passed along to the customer.

Features include horizontal design for stacking; completely sealed semi-metallic rectifier; lifetime cooling system; Cam-lok terminals; and electric control. Each of the two models available has dual current ranges: Model H-3-SR, 40 to 295 and 75 to 450 amp; Model H-4-SR, 50 to 350 and 100 to 600 amp.

Miller Electric Mfg Co, Appleton, Wis

MORE DATA? Circle 104, inside back cover

Improved Dyna-Trol Furnaces Have New Base and Convection Fan

Modified base construction incorporates extreme compactness with control visibility and convenience. Forced convection fan provides an automatic and even gradient in the furnace at any point along the heat curve. Operating temperature is 1875 F with fan; for operation above this point, the fan is easily and quickly removed.

Constant level of temperature can be maintained ranging from 300 to 2300 F by input controllers. These can be set from 7% to 100% of input. Zone gradient control operates by multiple circuits with each circuit having its own input controller. Gradients are indicated by a pyrometer and two thermocouples, located zonewise, and a thermocouple selector switch.

L & L Mfg Co, 804 Mulberry St, Upland, Chester, Pa

MORE DATA? Circle 105, inside back cover

Cadco Nylon Available in Rods 3 to 9 in. in Dia, Any Length

Massive nylon rods in diameters from 3 to 9 in. are furnished in standard lengths up to 10 ft and may be obtained in unlimited lengths on special order.

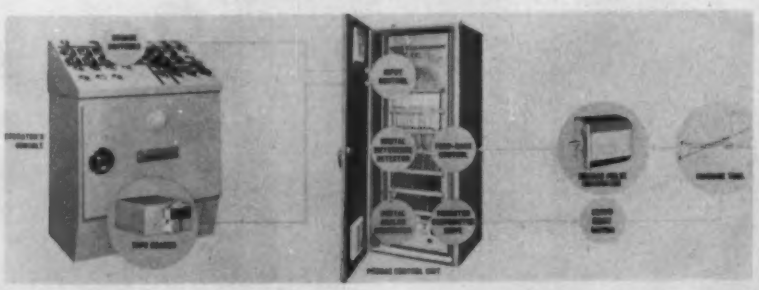
Applications include production of parts for bearing purposes as in rollers, cams, and gears with integral bearings. Because nylon bearings in many instances require no lubrication, the material is especially recommended for applications where lost oil is a problem.

Cadillac Plastic & Chemical Co, Detroit, Mich

MORE DATA? Circle 106, inside back cover

DOVETAIL TOOL BLANKS for automatic bar machines are available in form and shave types in standard sizes. Furnished in either M-2 HSS or T-5 Super HSS, they are ground all over and heat treated for maximum cutting life —*Somma Tool Co, 109 Scott Rd, Waterbury, Conn*

MORE DATA? Circle 107, inside back cover



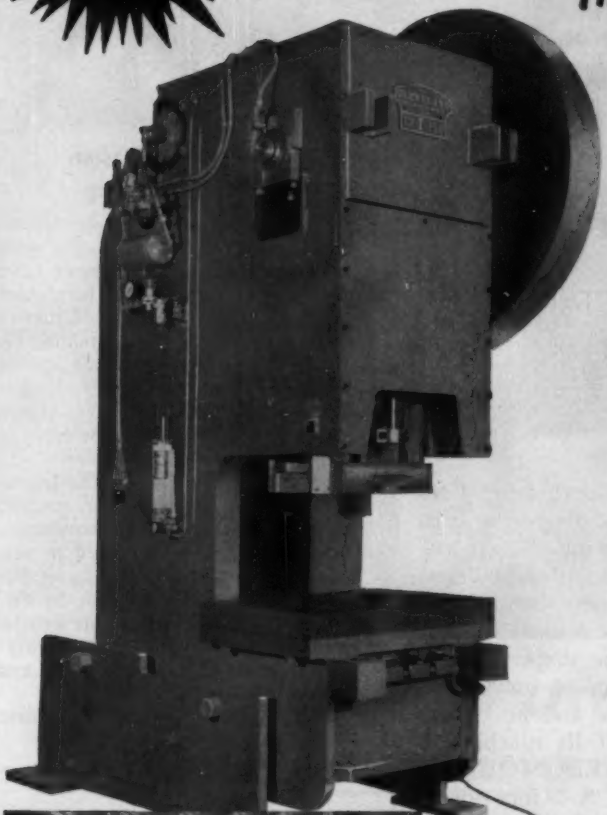
NUMERICAL CONTROL SYSTEM employs all-static, all-transistorized circuitry for automatic machine tool control. Prodac programmed digital automatic control consists of five basic units: operator's control and tape reader, Prodac control unit, Rotrac pulse generator, and drive motors. Decade switches on operator's console establish machine movement to any point up to 999.999 in.—*Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa*

MORE DATA? Circle 108, inside back cover

...DOES TOUGH JOBS *Dependably, Profitably*

CLEVELAND

NEW **WELDED-FRAME COST-CUTTING** *Open Back Inclinable* **PRESSES**



At the Middletown Manufacturing Co. in Middletown, Ky., this new welded-frame Cleveland OBI Press is blanking and piercing 1/16"-thick steel for reclining chair fixture parts and blanks for compressor cases. This Model 13-I has 150-ton capacity, 6" stroke of slide, 4" slide adjustment, 30 x 45" bed area and operates at 35 strokes per minute.

A-2548A

● Stronger structural frame—streamlined and built to withstand the shock and vibration of heavy-duty stamping.

Dies last longer with less downtime for die maintenance due to Cleveland's large box-type slide that results in greater production accuracy.

75 to 200-ton capacity, built for safer, more efficient operation with all gears and drive mechanism guarded.

Ruggedly built for many different press operations, material can be fed in from either side or from front to back.

Three different positions—vertical, 15° and 30°—to accommodate various types of dies and at the same time make use of gravity feed and discharge in automated production lines, or in operations using a single press.

You get better stampings for less with a CLEVELAND Press—the new welded-frame cost-cutting Cleveland OBI Press.

Write Today for Cleveland's OBI Press Catalog OBI 3-60

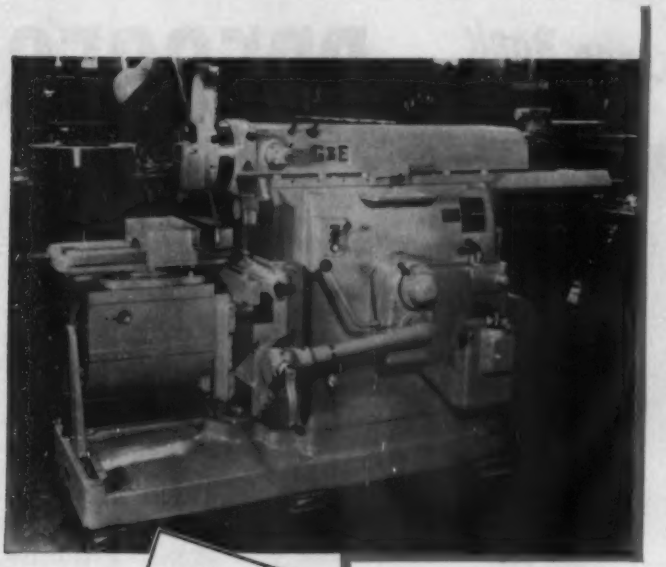
THE CLEVELAND PUNCH & SHEAR WORKS CO.
Established 1880

Power Presses
Fabricating Tools
Punching Tools & Dies

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

Can You Hold Your Shaper Without Bolts?

YES- with new WEDGMOUNT which anchors Shapers, Presses, etc. *and* permits precision leveling!



Free folder gives complete facts about

WEDGMOUNT with—

"Air-Loc" patented vinyl, sisal and cork pads top and bottom grip machines to floors

•

double-wedge construction which permits immediate precision leveling

•

keyed construction which prevents movement *within* the mount

•

sizes available thru distributors, and prices

This Gould & Eberhardt 24″ Industrial Universal Shaper, operating at 120 cuts per minute with a 4″ stroke, is installed without bolts on a new type machinery mount called WEDGMOUNT. A dial indicator at the base of the shaper showed a total oscillation of only .022″ during operation, and no "walking." The 7,800 lb machine is installed on six WEDGMOUNTS, each type 3″ x 6″ S. Before operation, precision leveling is achieved by simple adjustment of a bolt within each mount. Top and bottom of each mount is surfaced with patented "Air-Loc" pads, which provide the high degree of friction required to hold the machine in place despite its strong lateral thrust, and greatly reduce transmitted vibration.

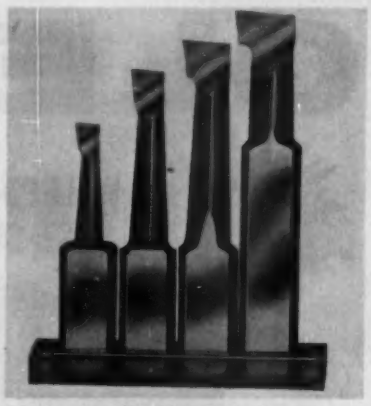
Air-Loc® **WEDGMOUNT**

4-17-4

write to... **Clark-Cutler-McDermott Co.**

100 West Central Street • Franklin • Massachusetts

NEW SHOP EQUIPMENT



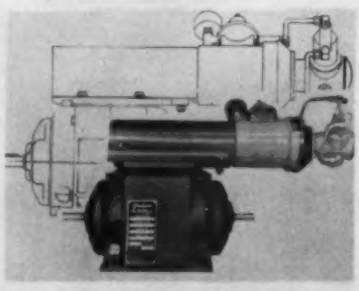
Boring Tool's Shank Design Permits 3-Point Clamping

Line of HSS and carbide tipped boring tools has round shanks with ground parallel flats to provide solid 3-point clamping with maximum rigidity and strength. In addition to simplified setup. Resharpening is easily accomplished without special holding fixtures since the round shank has four parallel flats which reduce grinding time on the tools to a minimum.

Designed for use in engine lathes, turret lathes, jig borers, automatics, boring heads, and boring machines, the tools may be purchased in sets packed in fittted cases in any of five shank sizes from ⅜ to 1 in. in carbide or HSS. Individual tools may be selected from complete line in varying shank sizes, hole diameters, and lengths.

Lido Tools, 843 W 16th St, Costa Mesa, Calif

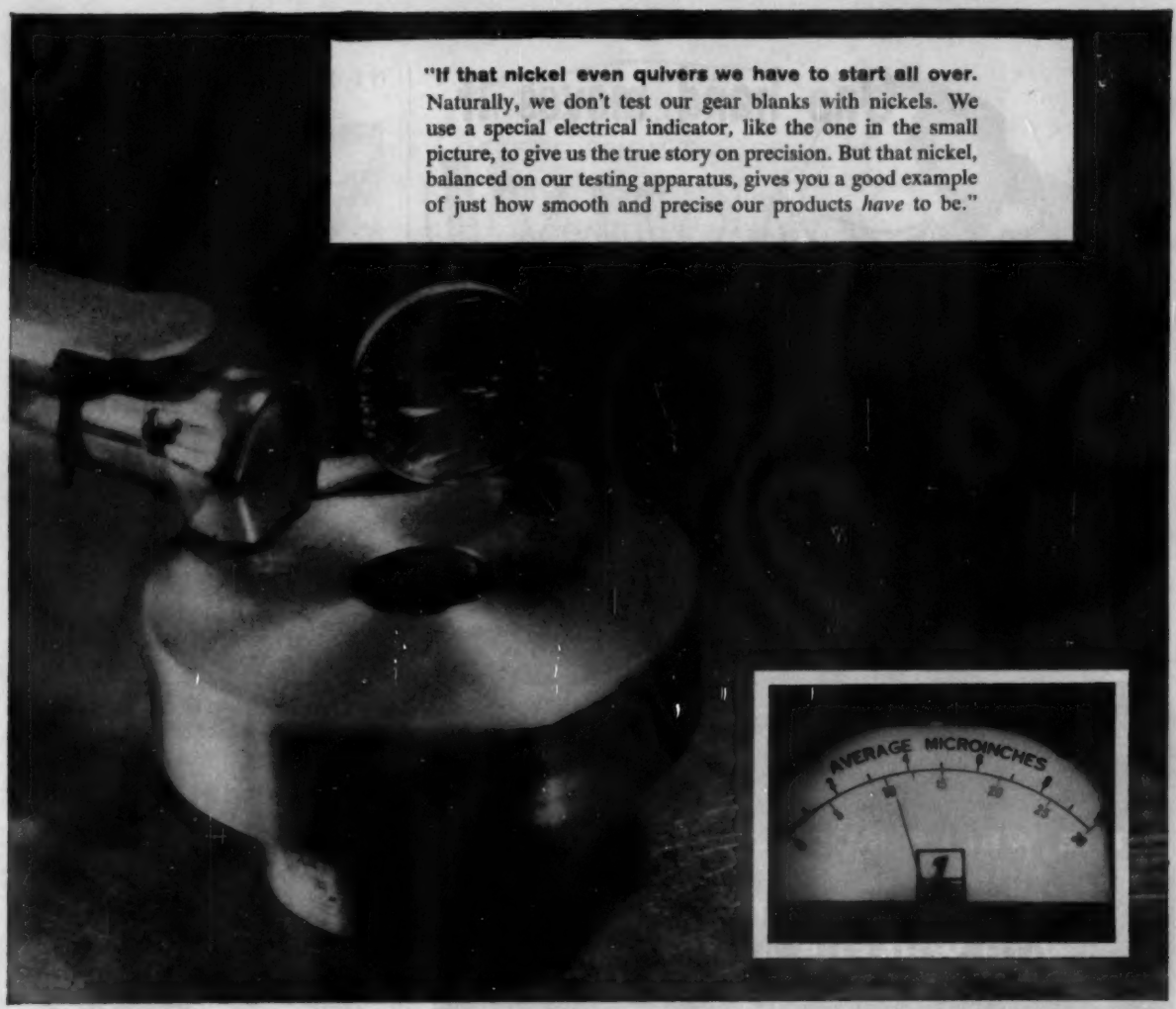
MORE DATA? Circle 109, inside back cover



VARIABLE SPEED TRANSMISSION with new air control provides remote or automatic speed control over an infinite range; air signals produce linear speed variation from desired max speed to zero. This new design finds particular application for precise feed or metering control and for automatic speed control systems—*Graham Transmissions Inc, Menomonee Falls, Wis*

MORE DATA? Circle 110, inside back cover

"If that nickel even quivers we have to start all over. Naturally, we don't test our gear blanks with nickels. We use a special electrical indicator, like the one in the small picture, to give us the true story on precision. But that nickel, balanced on our testing apparatus, gives you a good example of just how smooth and precise our products *have* to be."



"We depend on Cities Service for absolute precision!"

Lester E. Hoffmann, Treasurer and Vice-President
American Screw Machine Products Co., Chicago, Ill.

"The screw machine business is a highly competitive trade. We've built our business and our reputation on top quality, high-precision products . . . gear blanks that require the closest tolerances in *all* aspects. That means *we have to have* the best-quality cutting oil available. We've depended on Cities Service for nearly 25 years and they've never let us down."

"Matter of fact," says Mr. Hoffmann, "they insisted we try other brands just to prove that Cities Service was the best for us. They proved their point. We've stuck with Cities Service."

At the present time, American Screw Machine Products Co. is using Cities Service CHILLO 10 Cutting oil, and some CHILLO 22. As Mr. Hoffmann says, "The sulphur and chlorine additives prevent welding and galling action which allows for fine finishes and long tool life that maintains high-precision, top-quality work."

If you use petroleum products in your operations, why not talk with your Cities Service Lubrication Engineer? He can help you get the most from your operations by giving you the finest products, the best service available. Or if you prefer, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

SEE US AT THE IRON & STEEL EXHIBITION, SEPT. 27, 28, 29, 30, CLEVELAND, OHIO

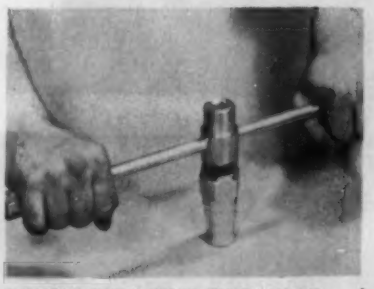
We've taken our popular Model 49A . . . put it on heavy duty, rubber tired, ball bearing wheels . . . added a smooth one piece fold-down handle. Here's a metal cutting band saw that's REALLY MOBILE . . . that can be wheeled wherever needed . . . quickly . . . easily.

The Wells Model 49A is a dual purpose saw. As a horizontal cut-off machine, it has a capacity of 3½" x 6". Swing the head into vertical position . . . it becomes an upright band saw for cutting angles, slots, notches, bevels and contour work.

The wheel and handle unit is optional equipment, available both for new machines and those already in service. The modest cost will be repaid many times over in time and labor savings. Your local Wells Distributor can give you the details . . . or if you prefer, write for Bulletin 253-H.

Wells

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
2700 Pine Street, Three Rivers, Michigan



DOUBLE-DUTY STUD EXTRACTOR and driver for hand or power operation will extract, without marring or damaging, any stud that will stand the torque necessary to release it. Bi-Way Studder is available in four sizes covering a range from 8¾ in. NF or NC threads—*E V Nielsen Inc, 575 Hope St, Stamford, Conn*

MORE DATA? Cidcle 111, inside back cover

Air-Powered Screwdriver-Nutsetter Features Automatic Push Starting

Model 420 with automatic push starting to speed assembly line operations operates at speeds up to 3000 rpm and is a straight type unit with hand lever control. Designed for assembly and fabrication of all plastic, wood, and metal components, the unit adapts readily to the use of several types of screwdriver bits. Conversion of power bits from screwdriver to nutsetter can be accomplished on the job. The tool is also available with either positive or adjustable clutch to suit specific job conditions.

Airetool Mfg Co, Springfield, Ohio

MORE DATA? Circle 112, inside back cover

Circular Gage Plates Supplied With From One to Six Holes

These plates eliminate much of the bulk of the styles in general use; a six-hole plate is only 11½ in. in diameter. They can take the place of the oldstyle plates in Seibert tool control systems or they can be used for presetting tools where operations

are not extensive enough to warrant the use of tool control boards.

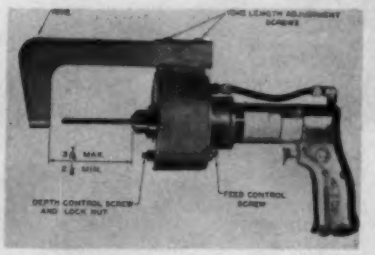
Gages furnished with these plates have hardened interchangeable heads which contribute to reduced tooling costs. They are made in bar height, chamfer, flush-pin, and flush-pin with indicator.

Seibert & Sons Inc, Chenoa, Ill

MORE DATA? Circle 113, inside back cover

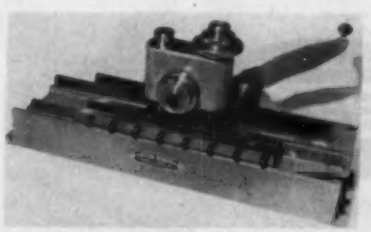
DIAL INDICATOR COLLET simplifies mounting of dial indicators in fixture gaging, special gages, and instruments. Collet provides uniform pressure distribution to eliminate possibility of binding indicator spindle—*Unigage Corp, Box 141, Downers Grove, Ill*

MORE DATA? Circle 114, inside back cover



DRILL FEED ASSIST ATTACHES to No. 10 drill for precise depth control and better drilling speed. Field tests increased rate 5 times. Assist is available in 500, 1500, 2000, 2700, 4000, and 5000 rpm models—*Cleco Air Tools, Houston, Tex*

MORE DATA? Circle 115, inside back cover



GRADUATING AND MARKING MACHINE is very accurate for positioning and indexing of circular graduated machine tool dials and micrometer spindles up to 6-in. dia. Price is about $245—*Dayton Rogers Mfg Co, 2824 13th Ave South, Minneapolis 7, Minn*

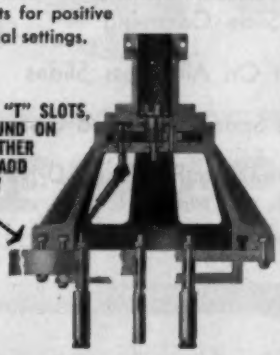
MORE DATA? Circle 116, inside back cover

JARVIS UNIVERSAL JOINT MULTIPLE SPINDLE HEADS

* For example, you can add to the basic head one or more of 20 optional accessories (such as Spindle Assemblies, Spindle Cluster Plate, Base Plate, Guide Rods, etc.) to meet the requirements of a particular job. With Jarvis Heads you have a greater selection of parts and accessories. A buy-only-what-you-need, custom-built head without having to pay the high cost of regular custom designed heads. Universal joints are of an advanced structural design which feature: low deflection rate; superior fatigue resistance; greater overload capacity and longer life. Joints have a snap-on feature and can be slipped off the spindle without use of tools.

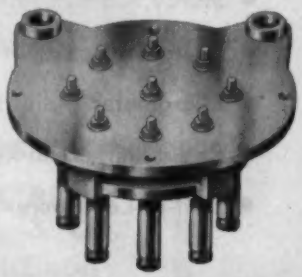
EXCLUSIVE JARVIS FEATURES

Cut-away view (below) reveals high strength, light weight aluminum alloy castings, heavily ribbed for durability; gears and spindle drivers run in ball bearings, have more than thrust load capacities; idler gears mounted on heavy duty needle bearings running on specially heat treated steel studs; adjustable outrigger arms locked in position with threaded studs located in double "T" slots for positive positional settings.



NO NEED TO INVENTORY SEVERAL FIXED HEADS

Head converts easily to a fixed head by adding a Jarvis Spindle Cluster Plate (shown below) which can be jig bored, by you or by us, to locate spindles to suit hole spacing required. Cluster Plates will aid in reducing setup time and will assure correct setup each time.



Jarvis CORPORATION

SEND TODAY FOR COMPLETE DETAILS

JARVIS CORPORATION,
26 Pease Ave., Middletown, Connecticut

____Send U.J. Multiple Spindle Head Catalog

Name _____ Title _____

Company _____

Street _____

City & State _____

Now . . . 3½" Capacity With This New Greenlee

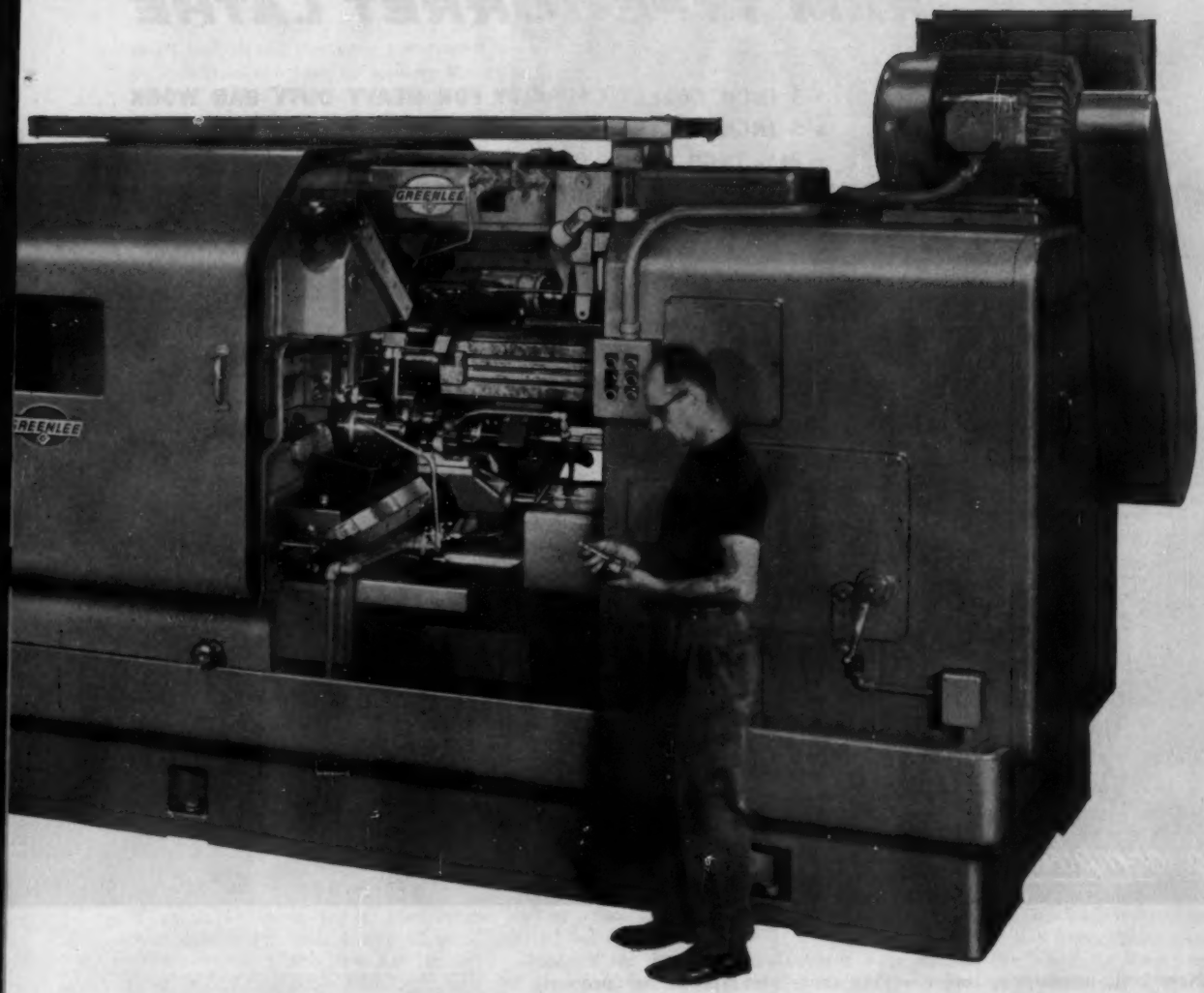
Biggest of the Greenlee Bar Automatics! This new 3½"— 6 spindle model offers the most outstanding advantages in the field. It is exceptionally versatile. It offers well-known Greenlee dependability. Like all Greenlee Automatics it has independent, cam-operated cross slides and a wide-open tooling area. Greater flexibility, accuracy and productivity are built into this big, powerful Greenlee Automatic. Check these outstanding advantages:

- Permanently Aligned Spindle Carrier
- Positive, High-Speed Carrier Indexing
- Wide-Open, Easily Reached Tooling Area
- Sturdy, Cam-Feed Main Tool Slide
- Interchangeable Cross Slide Camming
- Micrometer Adjustment On All Cross Slides
- Rapid-Shift, Dual-Range Speed and Feed Gears
- Built-in Lead Screw Threading Feed and Drive

PRODUCTION MACHINERY
GREENLEE

Other Greenlee 6 Spindle Bar Automatics are offered in 1", 1⅝", 2" and 2⅝" capacities.

TRANSFER MACHINES • SPECIAL MACHINES • SIX AND FOUR SPINDLE AUTOMATICS • TRIM PRESSES



GREENLEE® BROS. & CO.

1938 MASON AVENUE, ROCKFORD, ILLINOIS

DIE CASTING MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC AND HAND TOOLS

NEW BARDONS & OLIVER No. 6 RAM TYPE TURRET LATHE

- 3 INCH COLLET CAPACITY FOR HEAVY DUTY BAR WORK
- 5 INCH COLLET CAPACITY FOR LIGHT DUTY BAR WORK
- 21⅛ INCH SWING OVER BED WAYS

New bed, headstock, tool carrying units and aprons are properly proportioned and integrated to produce a truly functional lathe. It offers greater metal removal capacity, while holding today's most demanding tolerances!

In the design of this lathe, the operator was not overlooked. The number of operating controls has been reduced—grouped by function—scientifically located within easy reach. Generous use of aluminum and redistribution of weight results in improved balance and freer traverse of tool carrying assemblies.

For more information on how the new No. 6 can speed up your machining operations and build increased profits, contact the nearest Bardons & Oliver representative or write directly to our home office.

Bardons & Oliver, Inc., 1633 West 9th Street
Cleveland 13, Ohio

NO. 6 FEATURES

- Sixteen Geared Spindle Speeds—50 to 1 speed range
- Constant Horsepower (optional to 30) at all spindle speeds
- Fully Automatic spindle speed changes
- Twelve Fast Feed Changes for cross slide, carriage and hexagon turret
- Single Dial Feed Selectors on both aprons
- Power Rapid Traverse to the cross slide

BARDONS & OLIVER

Manufacturers of Turret Lathes and Cutting-Off Lathes

CIRCLE 260 READER SERVICE CARD

FIELD REPORT...

McKay Machine Buys Berkeley Co

Berkeley Co, Danville, Ill, producer of automatic arc welding equipment for the automotive, steel, and aircraft industries, has been purchased in a cash transaction by McKay Machine Co of Youngstown, Ohio, designer and builder of sheet and coil processing equipment.

McKay is also scheduled to purchase the Federal Machine & Welder Co of Warren, Ohio, and its subsidiary, Berkeley-Davis Inc of Danville, Ill. Move has approval of directors and stockholders of both firms.

Perkins Acquires Gear Inventory From Gleason Works

Perkins Machine & Gear Co, West Springfield, Mass, has taken over the entire inventory of standard stock spiral bevel gears from the Gleason Works (Rochester, NY) which has recently discontinued this phase of manufacture and sales. Purchase includes finished stock, drop forgings, and engineering specifications. Perkins intends to bring the inventory into balance immediately with a complete stock of spiral bevel and hypoid gears in the most commonly used ratios and sizes.

Avco's Crosley Division Gets Namelifting

Avco Corp, Cincinnati, is changing the name of its Crosley Division to the Avco Electronics and Ordnance Division. New name is felt to be more descriptive of work done. "Crosley Division name has long been associated with a line of consumer items which we no longer produce," states John Mihalic, president of the division, and a vice president of Avco. Crosley today is engaged almost entirely in the design, development, and production of electronics and ordnance items for the armed services. New division will continue to be a part of the Avco Defense and Industrial Products Group.

Double duty machining head is specially designed and built by Mahon engineers to work on a 53° taper. Here, head is being used to hold a 14-in. grinding wheel to obtain an 8 micro-in finish on the hardened seating area. Head, which also can be used to handle conventional cutting tools in roughing, is guiding the grinding wheel upward toward the apex of the work automatically as the bell is rotated. The close tolerance finish on the fitting diameters of the two huge blast furnace parts is required to assure a gas-tight fit when they are mated in assembly

Simplex-Hitemp Merger

Directors of Simplex Wire & Cable Co of Cambridge, Mass, and Hitemp Wires, Inc, of Westbury, Long Island, have approved a plan which will merge Hitemp into Simplex. Plan will be submitted soon to stockholders of both companies.

Simplex has been a manufacturer of insulated wires and cables for power transmission, communication, control, and signaling purposes since 1885. Hitemp, organized in 1951 makes insulated wires and cables for high temperatures. Its products are used primarily in guided missiles, electronics, and business machines.

American Optical Co's . . .

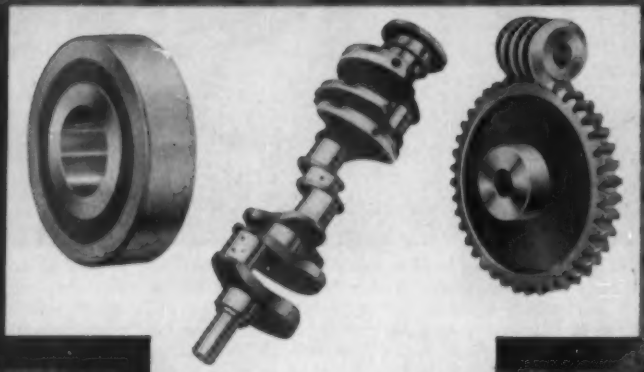
. . . Instrument Division in Cheektowaga, NY, plans to expand its product line by manufacture of electronic recording machines for industry. Division previously has specialized almost entirely in development and production of optical instruments. The machine has been under development at the plant for two years. The electronic recorder "writes" lines on a moving strip of graph paper that records such physical qualities as temperature, pressure, humidity, stress, or rate of flow.

McGIRK'S WORKS

by GEO. CRENSHAW

SCRUGGS, THE WOMEN IN THE PAINT DEPARTMENT ARE WASTING TOO MUCH TIME GOSSIPING. I WANT YOU TO CLAMP DOWN ON THE SITUATION IMMEDIATELY!
I'LL TAKE CARE OF IT RIGHT AWAY, BOSS!
MOE'S CORNER
I tried that same trick on my wife. But it didn't work. She's a VENTRILOQUIST.

VALVOLINE
Tectyl
protects metals against RUST



VALVOLINE'S amazing Tectyl rust preventives protect metal surfaces against *rust and corrosion* during storage and shipping.

Low-cost Tectyl compounds are easy to apply by brush, spray or dip and just as easy to remove. They protect metal surfaces against the effects of snow and rain ... salt air, humidity, perspiration and corrosive fumes.

Tectyl rust preventives meet exacting government specifications.

Write today for these two helpful Tectyl charts

1. "Valvoline Tectyl U. S. Government Approved Packaging and Preservative Chart." Gives the Army, Navy, Air Force and other Government Agencies' specifications and applications.

2. "Valvoline Tectyl Industrial Rust Preventive Comparison Chart." Specifies applications covering the industrial field.

VALVOLINE Tectyl RUST PREVENTIVES

VALVOLINE OIL COMPANY ... Pennsylvania

Field Report . . .

Kelsey-Hayes Moves Plant

The entire McKeesport, Pa, plant operation of Kelsey-Hayes Co will be moved to the Detroit area. Facility employs about 800 and is the company's largest producer of auto and truck wheels. Transfer of operations to the firm's new Romulus Township plant should be completed by early next year. The firm's general offices and its stamping plant, now in Detroit, will also be moved to Romulus. Two other plants will continue operations in Detroit and in Jackson.

New Company to Make Stampings

The formation of a new company, Dupli-Tronics, Worcester, Mass, has been announced by Ted Parker, president. The firm will specialize in the production of metal stampings in short or medium runs at low cost. The sales department is set up to furnish overnight quotations, and the production division will operate on two shifts a day.

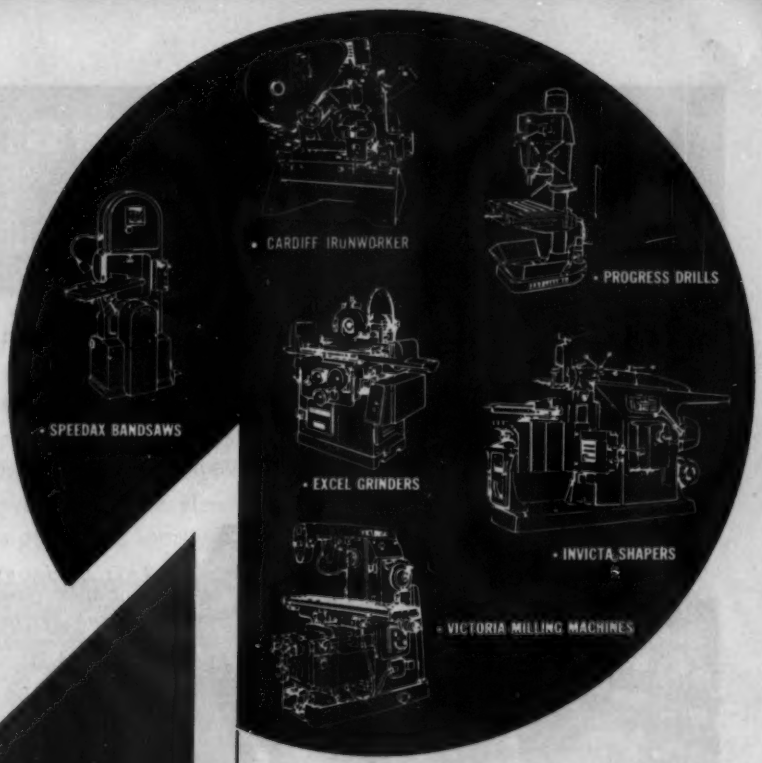
Du Pont Plans $2 Million Lab

The Du Pont Co is planning to spend $2 million for a new sales service laboratory for industrial chemicals at Chestnut Run, near Wilmington, Del. Product lines involved include adhesives, adipic acid, "ludox," colloidal silica, sulfamic and hydroxyacetic acid, methylamines, and propionates.

"I've taken a cold shower every morning for years. . . My wife and daughters get up first."

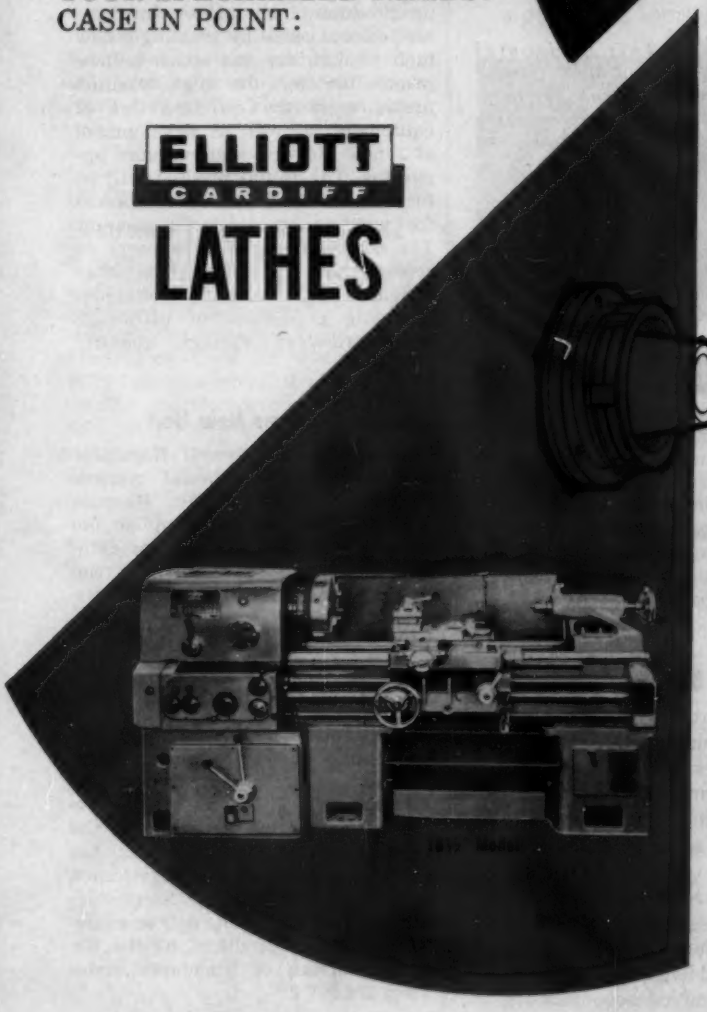
ELLIOTT MACHINE TOOL BUILDERS

A COMPLETE PROGRAM FOR YOUR SPECIALIZED NEEDS! CASE IN POINT:



ELLIOTT
CARDIFF

LATHES



A wide range for heavy duty, tool-room precision and fast production

13″ to 22″ models

Exclusive features—designed to reduce production costs, increase safety, speed and dependability:

3 1/16" hollow spindle, big hole-through capacity

- the most modern up-to-date design
- flame hardened and ground bed
- totally enclosed versatile feed box
- 120 feed changes without change wheels
- double-walled apron
- hardened ground gears and spindle
- heavyweight rugged castings

ELLIOTT

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MACHINE TOOLS Manufacturers (a division of the world's foremost machine tools manufacturers) fulfills the demand for quality MACHINE TOOLS and competitive pricing "backed" by all the advantages of domestic machine tools: ■ Factory Distribution and Service ■ Controlled Dealer Franchises ■ Frequent Personal Contact with our Executives ■ Full Inventory of Spare Parts ■ Factory Service Engineers ■ Factory Technical Service HOME OFFICE AND PLANT: Port Hope, Ontario/LOS ANGELES, CAL.: 1128 Crenshaw Blvd./BOSTON, MASS.: 19 Brook Street, Needham Heights, 94/ CHICAGO, ILL.: 518 Main Street, Evanston

CIRCLE 262 READER SERVICE CARD

WHY MICROHONING* of Accumulator Bores provides processing short cut

American Bosch Division of American Bosch Arma Corporation has recently added hydraulic cranking systems and a wide variety of hydraulic accumulators to their extensive line of precision equipment. Microhoning is specified as the only machining operation performed in the bores of the accumulator housings—here is why.

This horizontal Hydrohoner has a hydraulically reciprocated carriage, a ten-foot stroke and a four-speed transmission.

PROCESSING ECONOMY

The accumulator housings are made from mill stock tubing that is mostly either cold rolled welded or cold drawn seamless steel (some of the 4.750″ I.D. tubing is aluminum alloy). Economical processing of tube bores is realized through the inherent efficiency of Microhoning in generating geometry, size and surface finish. Microhoning is the only machining done on bores ranging in diameter from 3.000″ to 6.180″ and in lengths from 6.375″ to 123″.

RAPID STOCK REMOVAL

Accumulator bores are rough—and finished—Microhoned on the horizontal Hydrohoner shown. It is designed to provide rapid stock removal and generate accuracy in long bores. Rough-Microhoning of the mill stock tubing bores removes up to .040″ of stock at a rate of better than .001″ per minute. Finish-Microhoning removes .004″ of stock while generating final accuracies and specified surface finishes.

FUNCTIONAL BORES

In addition to consistent bores that are well within specified size and geometry tolerances, Microhoning provides controlled surface finishes of 7-8 microinches, rms. The Microhoned surfaces are so consistent that a check on a precision surface analyzer is made only two or three times per eight-hour shift. Microhoned bores assure smoother operation and longer life for piston seals in assembled accumulators.

**Registered U. S. Pat. Off.*

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

Field Report . . .

Alloy Products Announces Increased Deep Drawing Capacity

Alloy Products Corp, which specializes in stainless steel fabricating, has announced an increase in deep drawing capacity at its Waukesha, Wis, plant. Recent purchases of equipment include a hydraulic triple action deep drawing press which will double plant capacities. It is already in operation.

Elion Opens Vacuum Division

Elion Instruments Co has extended its products line further into the high vacuum field by creating a new high vacuum division which will be responsible for the high vacuum problems of the standard line of equipment, as well as development of a new electron high vacuum apparatus. The initial product will be focused electron beam equipment for welding of metals in vacuum. The new division will also carry on research and development on other advanced high vacuum techniques including production of ultra-high and ultra-clean vacuum quantity products.

Honeywell Forms New Unit

Minneapolis - Honeywell Regulator Co has formed a special systems division at Pottstown, Pa. Purpose will be "the advancement of the state of the art of complex integrated control systems for industrial and military applications." The Pottstown plant was formerly the company's missile equipment division.

Transducer Lab Announced

Establishment of a laboratory for calibrating and certifying transducers, which are widely used in determining vibration acceleration levels in various test programs in the aircraft and missile industries, has been announced by MB Electronics, a division of Textron Electronics Inc. Calibration results will be equivalent to those produced by the National Bureau of Standards under Item 206.001 C.

Hercules Motors Forms New Division

A division has been set up by Hercules Motors Corp to specialize in custom machining and finishing of industrial and automotive engine components. President P O Peter-

son describes the market as one with a multi-million-dollar potential for Hercules. The new Special Products Division will handle custom machining and engineering operations for outside firms on such engine components as engine heads, transmission housings, and other major parts and assemblies. Company's production engineering department is slated to play an important role in the operation.

Titeflex to Make Swaged Fittings

Titeflex, Inc, Springfield, Mass, has been granted a license to manufacture and sell in the US the Resistoflex circumferentially swaged fitting for Teflon hose and hose assemblies. Resistoflex has also granted Titeflex an option to produce under license other Resistoflex proprietary products.

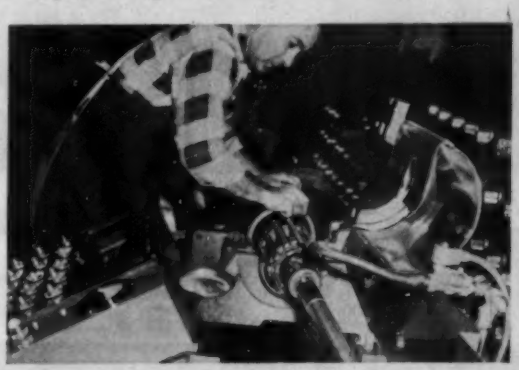
LA Corp Enters Nationwide Electronics Communication Field

H & B American Corp of Los Angeles has acquired nine community television antenna systems and two microwave companies from Jerrold Electronics Corp of Philadelphia. With this equipment, it plans to enter the electronics communications field on a nationwide scale. At the same time it was announced that Charles L Glett, nationally known executive in television and the communications industry, will be president of H & B and of Transcontinent Communications Systems.

"Yes, I saw the sign! But I didn't see you!"

HOW MICROHONING of Accumulator Bores provides processing short cut

Fast, economical generating of specified bore size, geometry and surface finish in accumulator housings is required by American Bosch Division of American Bosch Arma Corporation. Housings are made from mill stock tubing and Microhoning is specified as the most suitable process to consistently and quickly generate precision bores. Here is how a horizontal Hydrohoner provides a processing short cut.



The flange-type tool used to Microhone the 6.180" I.D. tubing has 8" long stones and four fibre guides. These stationary guides pilot the tool into the bore and prevent "collapsed" abrasives from marking precision bore surfaces when withdrawing the tool.

SIMPLIFIED PROCESSING

Because Microhoning characteristics include: rapid stock removal; consistent machining to specified size; correction of geometric irregularities; and generation of microinch finishes, there is no need for any other machining operation. Rough-Microhoning of the bores removes up to .040" stock at a rate better than .001" per minute. Then the finish-Microhoning operation quickly generates final size, geometry and surface finish. Thus, processing is simple; quick and economical.

AUTOMATIC GAGING

Gage Air Microsize is used to automatically terminate the Microhoning cycle as each bore reaches specified size. Microsize controls are interlocked with Hydrohoner controls, and the reciprocating gage spindle is synchronized with the tool spindle. Therefore, at each withdraw stroke of the tool, the gage spindle attempts to enter the bore. When it enters the bore, the air back-pressure is increased and at a predetermined back-pressure the Hydrohoner is automatically stopped.

HIGH EFFICIENCY

Another factor contributing to the high efficiency of this Microhoning set-up is the electric rotary feed tool. This design provides constant feed speed and maximum cutting action. Also, with rapid expansion and "collapse" of abrasives, it assures shorter cycle time than obtainable with conventional hydraulic feed mechanisms.

PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

—angles

—tapers

—contours

LeBlond Tape-Turn

FULL NUMERICAL CONTOUR

• solid state circuitry • no computer needed
• no hydraulics and heat exchangers
• no vacuum tubes • no templates

—plunge cuts

—facing cuts

—straight cuts

—radii

TURNING

Slopes, curves, straight cuts, angles, radii, tapers, facing cuts, boring cuts — you name it, this new LeBlond Tape-Turn Lathe can do it. And without steps, apologies, or a computer.

LeBlond Tape-Turn Lathes are all heavy-duty models with a special headstock and carriage engineered for General Electric's new Mark Century tape control. This potent combination can easily cut tracer turning time by half.

Here's all the stamina, power, and versatility you need for production work, coupled with the simplest contouring control yet developed. Uses 8-channel paper tape just like common positioning controls.

Requires only a sine-cosine table for programming slopes, and no special aids for straight cuts or curves. The console is equipped with a pushbutton keyboard for overriding the taped program.

Continuous path control — no steps. Screw cutting mechanism and control provision for curves with radii greater than 10" available on special order.

Ask a LeBlond representative today for a demonstration on one of your turning jobs. With LeBlond you cut with confidence.

The R. K. LeBlond Machine Tool Co.

Madison at Edwards Roads, Cincinnati 8, Ohio

LeBLOND of Cincinnati

CIRCLE 266 READER SERVICE CARD

W. C. "BILL" PINE, Hayes Chief Metallurgist, reports . . .

BRAZING CALLS FOR KNOW-HOW PLUS SHOW-HOW

Pioneer of controlled atmosphere heat treating, and developer of the *first* electric furnace for stainless steel brazing . . . Hayes today offers you one of the most extensive lines of furnaces and atmosphere generators for all types of metal bonding operations.

Hayes "KNOW-HOW" provides a customized brazing technique which takes into consideration every aspect of the job: Selection of alloys, placing and fixturing of work, choice of atmospheres, proper time-temperature cycles. Whatever the brazing application — from aluminum (900°F range) to platinum (3400°F range) — Hayes "SHOW-HOW" then proves the technique on full production-line equipment in our lab.

The Hayes answer to your brazing problem comes to you as a *complete package*. Our engineers provide free start-up service to duplicate laboratory results in your plant . . . fully instruct your staff to assure economical, maintenance-free brazing operations. The end product: a "Results Guaranteed" furnace-atmosphere combination that helps improve your product, increase production, and reduce costs. Write today for Bulletin 5711B describing typical conveyor-type brazing furnace.

C. I. HAYES, INC.

837 Wellington Avenue • Cranston 10, R. I.
Established 1905

ELECTRIC FURNACES

It pays to see Hayes for metallurgical guidance, lab facilities, furnaces, atmosphere generators, gas/fluid dryers.

Field Report . . .

Carrier Subsidiaries Consolidate

Carrier Corp has announced that its two Canadian subsidiaries have been consolidated to form Carrier Air Conditioning (Canada) Ltd and that Edward F Pope has been elected president of the new company. The business of the former Carrier Engineering Ltd and Bryant Mfg Co Ltd will be conducted by the Carrier and Bryant divisions of the newly combined subsidiary. Headquarters will continue to be in Toronto, with branch offices in Montreal, Winnipeg, and Calgary.

Willys Mediterranean . . .

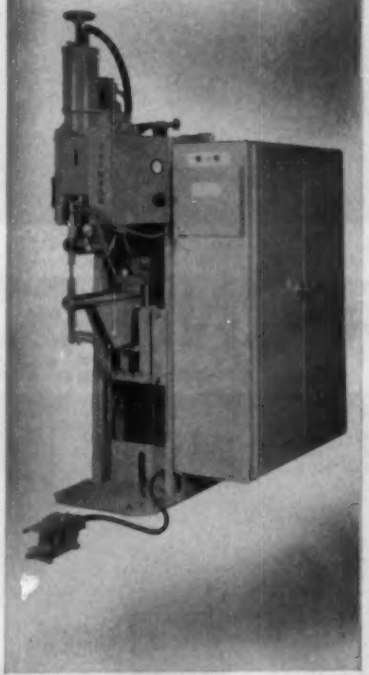
. . . has been incorporated in Palermo, Sicily. Company's officials report that Willys plans to establish a plant in Palermo or Catania for assembly, and later manufacture, of the entire line of Willys products. Emphasis at the outset will be on jeeps for civilian and military use. Organizational details for the Sicilian venture will be handled by the branch office in Zurich; the new company will handle all sales in the Mediterranean and Middle East areas.

Ford Constructs Oxygen Plant

Ford Motor Co has announced plans for construction of a new high-capacity oxygen plant as part of its steel operations at the company's Rouge plant area in Dearborn. The new oxygen plant will permit exploitation of a new open hearth steelmaking process recently announced by Ford.

"My wife deserves all the credit for my success. Her steady doubt and ridicule gave me the necessary incentive to get ahead."

The finest **RESISTANCE** *Welders* — *competitively priced!*



THOMSON manufacturing capabilities have resulted in reduced costs on their resistance welding machines of long recognized quality . . .

SPOT	**PRESS**
PROJECTION	**FLASH-BUTT**
SEAM	**HIGH-FREQUENCY**

For all **AUTOMATED** and **HIGH-PRODUCTION** requirements — either special or standard design — **THOMSON QUALITY** is within your budget. A quote from **THOMSON** will show you how.

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Inventors of Resistance Welding

THOMSON ELECTRIC WELDER COMPANY
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STRIPPIT SUPER 30 FABRICATOR

Larger work sizes for more efficiency...for short run punching — 30" x any length ... for production run hole duplication — 25" x 30".

Adjustable table for greater accuracy and flexibility...for punching to closer tolerances in angles, shapes and formed parts as well as flat sheets.

New, no-jam electric head eliminates down time...and the need for pressurized air. Fewer parts minimize maintenance — ensure quieter, more positive operation.

Wide range of hole punching capacities...from a 3½" hole (round or shaped) in 16 gauge to a ½" hole in ¼" mild steel.

Corner and edge notching...up to 5" x 5" in 16 gauge mild steel — 90° corners, rectangular, vee, radii and special shape edge notches.

Straight line nibbling and contour shearing...at 165-strokes per minute in ⅛" mild steel. Instant changeover from single stroke punching.

New swing-shift punch holders...quick-opening, positive-closing — for right or left-hand operation. Electrical interlock for safety.

Exclusive quick-change tooling system...using standard stock punch and stripping guide assemblies and die buttons. Size changes take less than 20 seconds.

New quick-set gauging system...with micrometer settings for fast, accurate layout and rapid work positioning.

EASY CONVERSION TO A PRODUCTION PUNCHING UNIT...

with the Strippit Duplicator which can be built-in as an integral part of the Super 30 Fabricator — and the Dupl-O-Scope for punching Duplicator templates from a drawing, layout or sample part.

WRITE TODAY... for complete details, illustrated literature, price and delivery.

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200 Buell Road, Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ont.

ONE MADISON RECESSING TOOL DOES THE WORK OF TWO...WITH SNAP-ON ADAPTOR!

New, snap-on work pilot adaptor converts the tool for piloting either in the work piece or in a fixture, enabling you to use the tool in any standard shop equipment. For even greater versatility, a replaceable nose piece permits the rapid changeover, when piloting in the work, from one piece part to another of different I.D. dimensions.

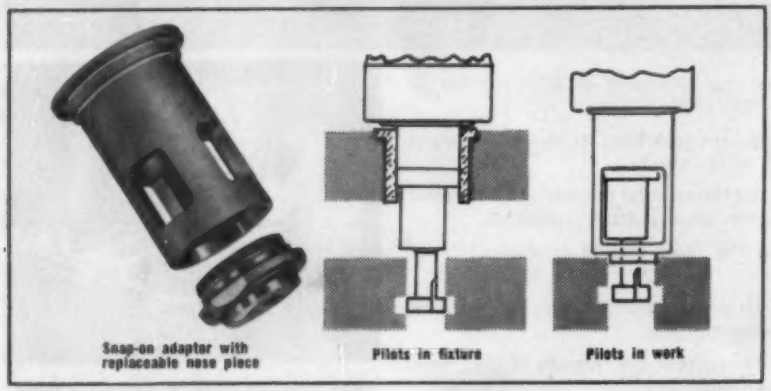
CUTS TO EXACT DEPTH, WIDTH AND POSITION . . . WITHOUT "CHATTER"

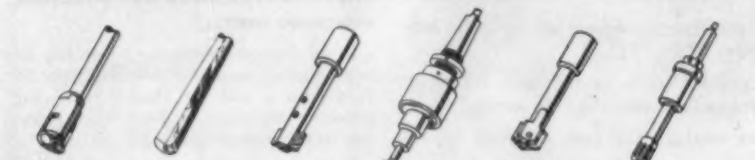
Because of a solid, single bar construction having a long bearing surface with only one joint, the Madison Automatic Recessing Tool eliminates deflection and run out. It cuts accurately to depth, width and position . . . in one operation.

A precision-machined feed cam and heavy duty feed pin assure uniform feed out of the cutter.

Through two calibrated adjustment nuts, you quickly and easily set the tool to exact specifications.

With less time needed for set up, and with a fraction of the production time usually required, the recessing tool can pay for itself in runs of 100 parts or less.





MADISON *Industries, Inc.*

P. O. BOX 1137, PROVIDENCE, RHODE ISLAND

Field Report . . .

Steel in Alabama

Survey of steelmaking facilities in the Birmingham-Gadsden area, the section in which most of the state's steelmaking facilities are located, has just been completed by an official of United Steelworkers of America. It shows 24,963 steelworkers employed with 20,000 of these on a 40-hour week. It further shows about 5000 working less than 40 hours per week. Comparable figures for six months ago show 29,000 at work, for a year ago, 38,000, and for two years ago, 42,000. Even so, Alabama's steelmaking rate — 58% of capacity — was still a few points ahead of the national average.

New Missile Plant Nears Completion

Studebaker-Packard Corp's new 21,600 sq-ft plant near Santa Ana, Calif, which will be engaged in missile work, is almost built. Here S-P will work on thermal-reentry aspect of the Pershing missile, under contract to the Martin Co. When the plant opens, about 80 people will be employed.

Keystone Controls Welding Firm

Keystone Engineering Co, Los Angeles, has just acquired a controlling interest in Western Arc Welding, Inc, also of LA. The welding firm, which specializes in precision welding of exotic metals for the defense industry, will continue to operate independently as a subsidiary company with E T Sherrick, former director of engineering, in charge as vice president and general manager.

$20 Million Order to Westinghouse

Westinghouse Electric International Co has been awarded a $20 million contract for a power station by the Mexican Government's Comision Federal de Electricidad. It's the largest single export order for steam-electric power equipment ever received by the company which is a subsidiary of Westinghouse Electric Corp. The 225,000 kw power station will be on the coast near Tijuana, ten miles south of the US border. It'll comprise three 75,000 kw steam-electric generating units and associated apparatus to be manufactured by Westinghouse plants in Lester, East Pittsburgh, and Sharon, Pa. Delivery will begin in late 1961 or early 1962. The Tijuana project is part of a $1 billion program to

double Mexico's electric power capacity in the next five years.

RCA Shifts Cherry Hill Plant

The Radio Corporation of America has announced that it will shift its Home Instrument Division and Sales Corp from Cherry Hill, NJ, to Indianapolis, Ind; this move will affect 800 employes at the Delaware township operation. The company states that a number of the people will be transferred to Indianapolis, and that every effort will be made to place the other employees in various RCA operations in the central New Jersey area.

Struthers Wells Buys Smith-Moon

Struthers Wells Corp, Titusville, Pa, manufacturers of equipment for the petroleum industry, is purchasing the Smith-Moon Co, Inc, Winfield, Cowley County, Kans, to complement its steel fabricating plants. The deal, which was made by cash payment rather than an exchange of stock, will give Struthers Wells a southwestern plant with accompanying freight and manufacturing advantages.

Detroit Tool & Die Co . . .

. . . Detroit, will begin operations this month in its new Hartsville, Tenn, plant.

"You'd tell me if you were on strike, wouldn't you, Nagel?"

MADISON SPADE DRILLS REDUCE TOOL COSTS 60%-80% OVER TWIST DRILLS

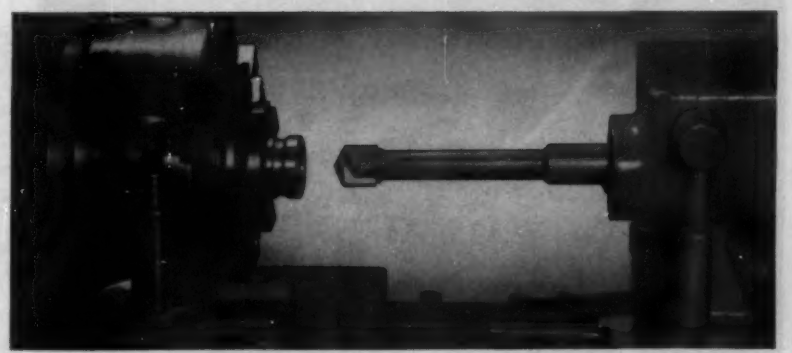
It's a fact! And here's the proof to back up our statement.

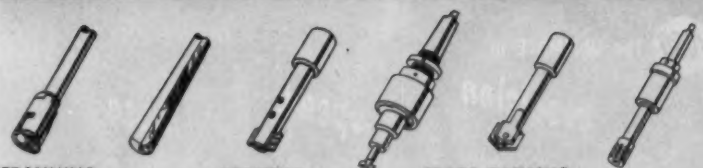
With Madison spade drills, the work is done in one pass from the solid — no need for progressive drilling. Damage to the tool is sharply reduced due to the forced flow of coolant through the Madison tool holder and the rapid elimination of the small C-shaped chips from the work. There's no stopping to remove chips.

You save money because of reduced tool inventories required. One Madison tool holder accommodates a wide range of bit sizes, and spade drills cost much less than twist drills.

Downtime is negligible. There is no need to remove tool, grind, replace and reset for depth as is necessary with twist drills. You merely change cutters at the machine — often while it is functioning on other operations.

Ask your local Madison Man to tell you more or write for our latest bulletin.





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MSO GRINDERS - PACEMAKERS
for better grinding methods—

The ultimate in precision grinding to close tolerances with micro inch finish — for Toolroom — for Production

MSO builds
Universal Grinders
Production Grinders with automatic plunge or traverse grinding cycles
Thread Grinders

When only the best will do — check MSO first

Model FMES Universal Grinder with compound swivel wheelhead capacity 7" x 12"

austin industrial corporation

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CIRCLE 272 READER SERVICE CARD

MSO JIG BORING MACHINE

WITH LEITZ OPTICS

Table size — 33½" x 18½"
Spindle speeds — 63 — 2000 RPM
Boring depth — 12"
Net Weight — 7500 lbs.

MSO The ULTIMATE in

precision

Setting accuracy .00002". Positioning accuracy .00012".

speed

Select any point as starting point. "Zero-in" scales by push button. Read scales to millionths without leaving operator's position.

ease

Direct reading on magnified screens in any quadrant from zero point. Table moves on double roller guides.

When only the best will do — check MSO first.

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

Field Report . . .

Bunting Adds Nylon Products

Bunting Brass & Bronze Co, Toledo, Ohio, has announced that nylon rods, tubes, bars, plates, and pressure tubing have been added to its line of cast bronze, sintered metals, and aluminum in the field of bearings and special parts. The new line will be known as Bunting Cadco Nylon, because it is a special formulation of nylon produced by Cadillac Plastic and Chemical Co, Detroit.

Big Pits at Reynolds

Reynolds Metals Co's alloys plant at Sheffield, Ala, has installed 14 new soaking pits capable of holding some 2300 tons of aluminum ingots at temperatures up to 1150 F. Designed and built by Rust Furnace Co, the gas-fired pits can handle ingots as long as 200 in. weighing up to 34,000 lb each.

Electronics Firm Buys Radio Co

Applied Electronics Corp of NJ has announced the purchase, as a wholly owned subsidiary, of Flight Electronics Corp, Westchester, NY. This firm designs, manufactures, and installs aircraft radio equipment for commercial, private, and military aircraft.

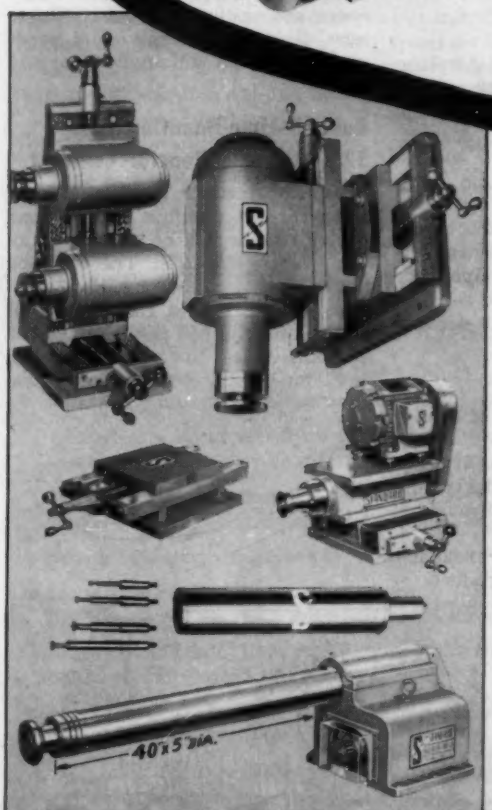
Aeroprojects Gets Two Patents

Aeroprojects Inc of West Chester, Pa, has been granted two basic US patents on ultrasonic welding; they contain method and equipment

"Do you want it straight from the shoulder or do you prefer it couched in the ambiguity of a full engineering report?"

THE HEART OF THAT SPECIAL MACHINE

MACHINE TOOL OR CONVERSION



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SPINDLES,

SLIDES, FEEDS AND TABLES by

STANDARD

Use the "building block" technique on that machine design problem. A Standard Super Precision Spindle **PLUS** the proper STANDARD slide, feed or swivel is truly "the heart" of the special machine that will do **your** special job.
Standard Super Precision Spindles will mill, drill, bore or grind and Standard slides, feeds and swivels will take the spindle to the work, or vice versa, ACCURATELY **A THOUSAND TIMES A THOUSAND TIMES!**

Send for Standard's complete new Spindle Catalog TODAY . . . working drawings, specifications, complete technical data, on "building block" installations working all over America right now!

Since 1912

the STANDARD electrical tool co.

SPINDLE DIVISION

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SUPER PRECISION SPINDLES AND MACHINE TOOLS

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HALLMARK OF METALWORKING THROUGHOUT THE WORLD

The Most for Your "Rockwell Testing" Dollar!

Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10201 Ford Road, Dearborn, Mich.*

FREE REFERENCE BOOK

All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

CLARK INSTRUMENT, INC.
10201 FORD ROAD
DEARBORN, MICHIGAN

Missile-Age Accuracy

Field Report . . .

claims on both ultrasonic spot-type and ultrasonic seam welding. Inventors named on both are Carmine F DePrisco, chief electronics engineer at Aeroprojects; William C Elmore, chairman of Physics Dept at Swarthmore College and consultant for Aeroprojects; and J Byron Jones, founder and president of Aeroprojects.

Douglas Gets Order for 21 Thors

The Air Force has ordered 21 Thor rockets of increased power from Douglas Aircraft Co. Eleven of these rockets, which will be used as booster vehicles to power satellites, will go to the Discoverer program; the other 10 will be used by the National Aeronautics and Space Administration.

New Air Research Plant

The Vertol Div of Boeing Airplane Co wants to construct a $2 million plant on a 15-acre tract near the Philadelphia International Airport. Plant would employ some 400-500 persons engaged in aviation engineering research and testing.

Plant is still in the planning stage. At the moment, company is negotiating with the City of Philadelphia for a long lease on the selected site and options on an adjoining 18 acres.

Canadian Outlet

Premier Industrial Corp of Cleveland has formed a subsidiary in Toronto, Ont, to market its 7000 industrial-maintenance products and provide technical services throughout Canada.

The subsidiary, Premier Fastener Ltd, will initially offer products of Premier's fastener and autoware divisions.

Lockheed Broadens Missile Activity

A $76.7 million contract has gone to the Lockheed Missiles & Space Div to develop a ground-space communications and control network for the Air Force's Discoverer-Midas-Samos satellite programs. The award formalizes a letter contract under which work has already begun.

Contract broadens Lockheed missile activity to include systems engineering and technical direction for the communications and control network. Company is already in several other phases of missile work.

GM Buys Plant in California

The Curtiss-Wright facilities in Goleta, Calif, which are adjacent to the Santa Barbara Municipal Airport, have been purchased by the Defense Systems Division of General Motors Corp. The 104-acre property in Goleta Valley which contains four buildings, is valued at $5.5 million. It has been reported that the closeness of the facilities to the ocean was an important factor in GM's decision to buy.

Missiles in Connecticut

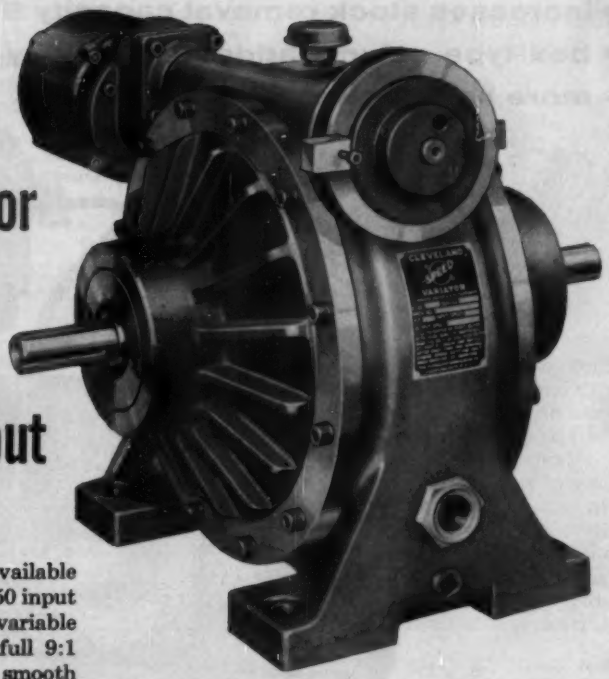
One of the newest missile makers is Gulf & Western Industries (Houston, Tex), which has purchased a factory at Manchester, Conn, belonging to the Mal Tool & Engineering Co. Transaction totaled more than $1 million. Mal Tool, the first missile maker to be associated with Gulf & Western, employs about 100 engineers and skilled machinists. Up to now, Gulf & Western's chief products have been automotive parts.

Baldwin-Lima-Hamilton Gets $2.3 Million A-Reactor Contract

Components which go into the nuclear core of the first civilian gas-cooled reactor will be built by Baldwin - Lima - Hamilton. The contract, which was awarded by H K Ferguson Co, Cleveland, calls for B-L-H to construct the pressure vessel, pressure vessel liner, and core support for the Atomic Energy Com-

"It's been an awfully long day. I got in on time this morning."

Cleveland Speed Variator is the Best Answer to *Precision Control* of Variable Speed Output



Advanced-designed Cleveland Speed Variators—available in 18 models ranging from fractional to 16 hp at 1750 input RPM—accurately provides dependable, infinitely variable speed control. They give stepless speed over a full 9:1 range—from ⅓ to 3 times input speed. Instant smooth change of output speed can be adjusted by either manual, automatic or remote control. Precise adjustments are always made with accurate adherence to settings.

Thousands of Variators are in daily use on such varied industrial equipment as cigarette-making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors and experimental and testing equipment of many types.

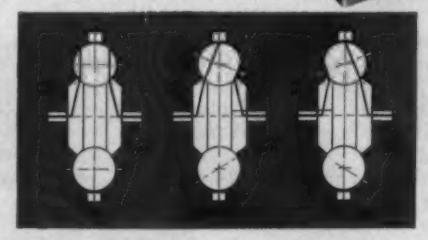
Check these major Variator advantages:

- An extremely compact unit with input and output shafts in line and rotating in the same direction
- Almost any input speed up to 1800 RPM can be used —either clockwise or counterclockwise rotation
- Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range
- Speeds infinitely variable over entire range of adjustment
- No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered
- Long life and minimum maintenance due to absence of belts or complicated linkages
- Ample bearing support for overhung pulleys on both input and output shafts

Write today for free Bulletin K-200 containing detailed description, photographs, sectional drawings, rating tables and specifications.

Simple in Operation... Built for Long Life

The Variator is an extremely compact unit with input and output shafts in line, rotating in the same direction. It incorporates ample bearing support to carry overhung pulleys.



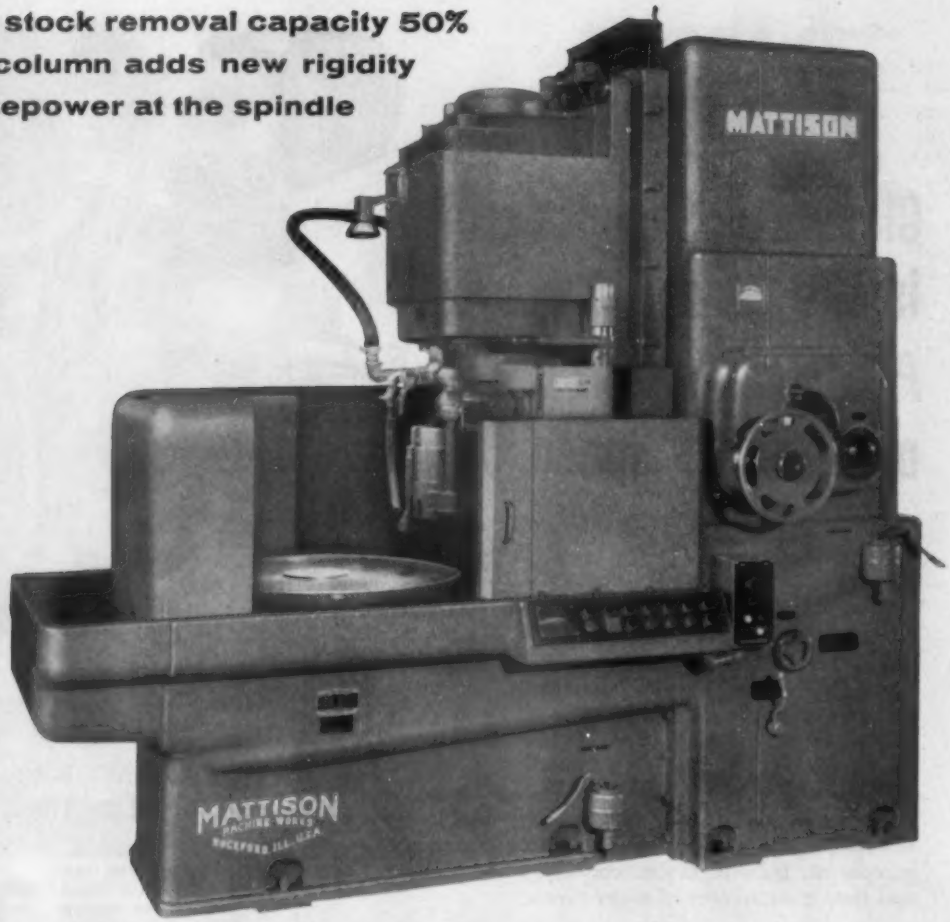
Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with the drive discs. Relative shaft speeds are adjusted by changing position of axles on which the balls rotate.

Cleveland Worm & Gear Division
Eaton Manufacturing Company
3254 East 80th Street • Cleveland 4, Ohio

EATON

CLEVELAND SPEED VARIATOR

- **increases stock removal capacity 50%**
- **box-type column adds new rigidity**
- **more horsepower at the spindle**



NEW MATTISON NO. 24

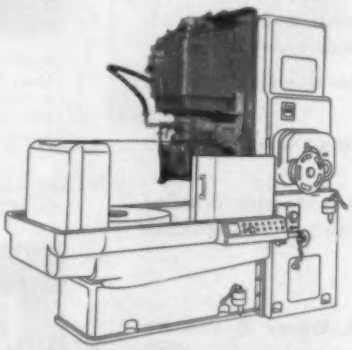
Increased production efficiency is the purpose of this new machine . . . power spindle tilting, continuous downfeed, and box-type column are reasons why it can grind parts fast and flat!

Mattison's new No. 24 vertical rotary surface grinder is designed for 30 to 125 horsepower spindle motors—takes only a fraction of the time normally needed to grind 42-in. diameter work!

Here is the only machine in its class with all the features you need to take full advantage of today's grinding wheels. Consider each of these advantages, now designed by Mattison into one grinder to combine precise tolerances and cross-grind finishes with high production and trouble-free operation.

125-spindle hp improves productivity

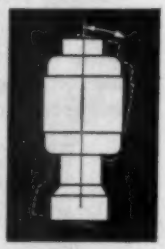
Coarse grit wheels are better cutting tools today than they were ten years ago. Individually formed aluminum oxide grains, each with a greater number of sharp edges, are held firmly by improved vitrified bonds. The new No. 24 is built to take advantage of these wheels. Up to 125 hp can be used on the spindle to provide high pressures per grain,



increase chip size, and maintain optimum wheel breakdown. Combination of high horsepower, high downfeed, and rigid construction gives you an economical stock-removal method—one that eliminates many of the hidden costs of cutter-type machining.

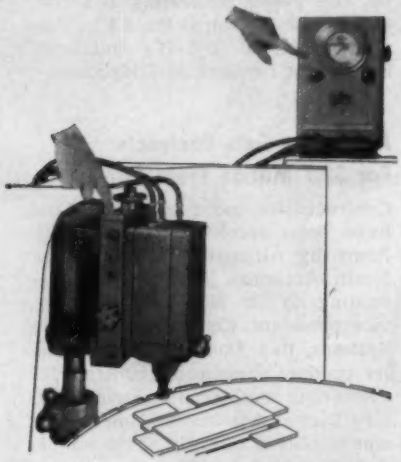
Rough and finish grinds in one setup

The No. 24 converts from a rough grinder to a finisher in seconds . . . combines positive cutting action and premium precision on every part. With Mattison's proved Quick-Tilt spindle, you can take a hogging cut while machining work within a few thousandths of final size. Grinding on the leading edge of the wheel with a high downfeed per minute, you can really increase grain penetration and stock removal. Then, by just turning a switch, you return the wheel to dead flat position for a finish grind, quickly producing accurate surfaces with a perfect cross-hatched finish.



Automatic gaging controls quality and cycle time

The best way to grind efficiently and accurately is by gaging from the work as the machine cuts. This

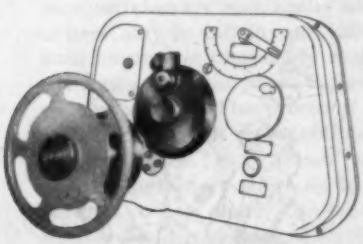


avoids guesswork and production losses resulting from hand checking.

You have a choice of two positive automatic sizing systems on the new No. 24. Both continuously measure pieceparts during the cut. An air-gaging system provides visual and electrical indication when work approaches size. The electromechanical system actuates the automatic cycle and returns the machine to reload position when preset size is reached.

Continuous downfeed makes no compromise with accuracy

Continuous downfeed is another reason you can increase both production and accuracy. Operator

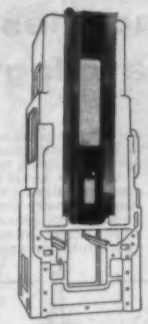


sets the feed from .005 in. to .165 in. per minute, and grinds to size in one uninterrupted cut without miking. Feed stops instantly, but only when work reaches desired size—not one increment away. You can split the last increment of a ratchet-type feed and meet closer tolerance limits. There's no feed rate limitation imposed by cam and linkage actuation.

Long-range predetermined stops (to .240 in.) increase efficiency on high stock removal jobs. Wide feed range gives exactly the right cutting condition for a rough or finish cut, depending upon material and horsepower distribution in the wheel.

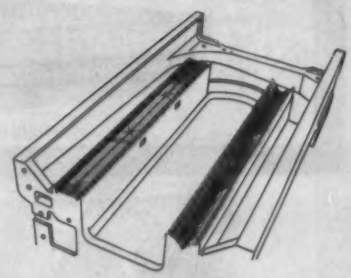
Box-type column stays put on hogging cuts

Mattison's one-piece, box-type column, bolted and keyed to the base, is equivalent to a one-piece "L"-shaped Meehanite casting and will give you a machine capable of maintaining accuracy on a stock-removal cut. Rigid support prevents deflection and vibration, lets you feed down to stops without leaving excess stock to remove during spark-out.



Of course, there are other important features to look for in a column . . . and you find them inside the clean lines of a Mattison. Our combination "V" and flat ways are wide, long, and deep. This prevents cramping and permits smooth, precise downfeed under light or heavy loads.

Cross-ribbing replaces coolant in base

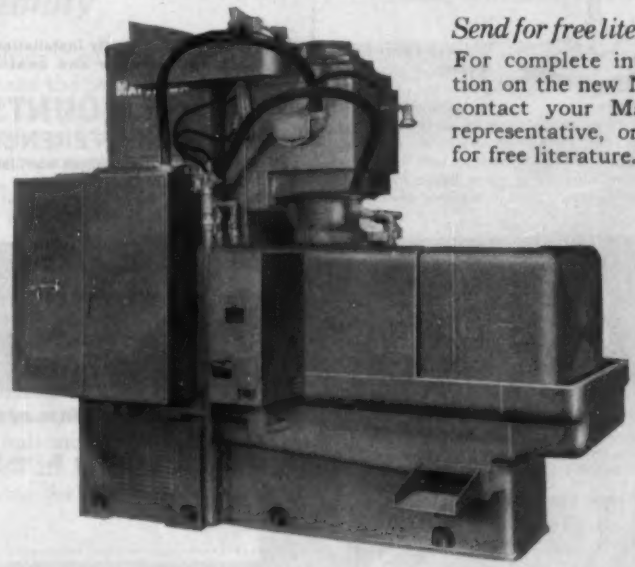


The base of a Mattison is no coolant container. To avoid thermal expansion, we keep coolant in an outside tank, substitute Meehanite ribbing for additional rigidity under the table where the load is centered. Meehanite bed, column, and other main castings are stress-relieved by heat treating. Extra-large "V" and flat ways provide maximum weight-bearing surface. They are closely spaced to prevent carriage deflection.

Completely guarded ways

In any position of the table or wheel head slide, ways of the bed and column are fully protected. A bellows-type guard covers the upper column ways. A telescoping steel guard protects the lower ways. Bed ways always are in full contact with the table carriage, giving maximum protection and support.

Subcontract grinding shops report increased profits from their new Mattison grinders. So, now is the time to think about replacement.



Send for free literature

For complete information on the new No. 24, contact your Mattison representative, or write for free literature.

MATTISON MACHINE WORKS ROCKFORD, ILL. U.S.A.

If it's a flat surface, there's a Mattison to grind it!

MATTISON MACHINE WORKS

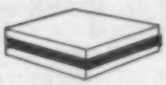
Rockford, Illinois • Phone WO 2-5521

NEW! UNISORB "UL" Machine Mount ...for machines with built-in leveling screws

The new model "UL" Unisorb Level-Rite Mount has been developed specially for use under machines with their own leveling screws.

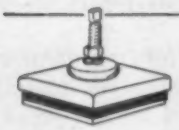
It combines a Unisorb vibration control pad with a cast steel base plate having a recessed center to accept the leveling screw. The Unisorb Level-Rite "UL" eliminates all need for anchor bolts or lag screws, and machines can be moved whenever needed. The Unisorb Pad reduces transmitted vibration up to 85%, allows higher machine speeds, cuts noise and lowers building maintenance.

Unisorb Level-Rite "UL" is available in a range of sizes and loadings, and with high or super density Unisorb — to meet all requirements. Ask about this mount — or any one of the other Unisorb Mounts — from your local distributor or write direct.



Unisorb Mounting Pads
Unisorb pads are the basic vibration control unit, identified by the red centers and brand mark. Available in a wide range of densities and thicknesses for proper application. Saves up to 80% in installation time and costs.

Unisorb Level-Rite 200
Unisorb Level-Rite "Junior" has been especially designed for light machines, air conditioners, business machines and similar equipment. A low cost, precision leveling device and vibration control unit, with loading limit of 200 lbs. per unit. Ideal for original equipment.



Unisorb Level-Rite Mount
Unisorb Level-Rite is a universal, self-contained leveling device for all types of machines. Fast, simplified way to achieve and hold precise level. Available with exclusive screw-post design or as a basic mounting plate for use with built-in leveling devices.

Remember — to simplify installation, improve performance and control vibration...

UNISORB MOUNTS MAKE THE DIFFERENCE

...for all types of machines from laboratory equipment to giant presses.
Ask for a Money-Back Trial... Now!

UNISORB

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Taylor Felt & Supply Co., San Francisco, Calif. • Acorn Mfg. Co., Los Angeles, Calif.

Please send me a Unisorb Sample and Free Book.

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Company.....
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FE 0-2

Field Report . . .

mission's Experimental Gas-Cooled Reactor at Oak Ridge, Tenn. Under the $2.3 million contract, component for the power-generating heart of the reactor will be at the 1.5 million sq ft plant of B-L-H's Industrial Equipment Division at Eddystone.

Autonetics Gets Contracts For $2.7 Million From Army

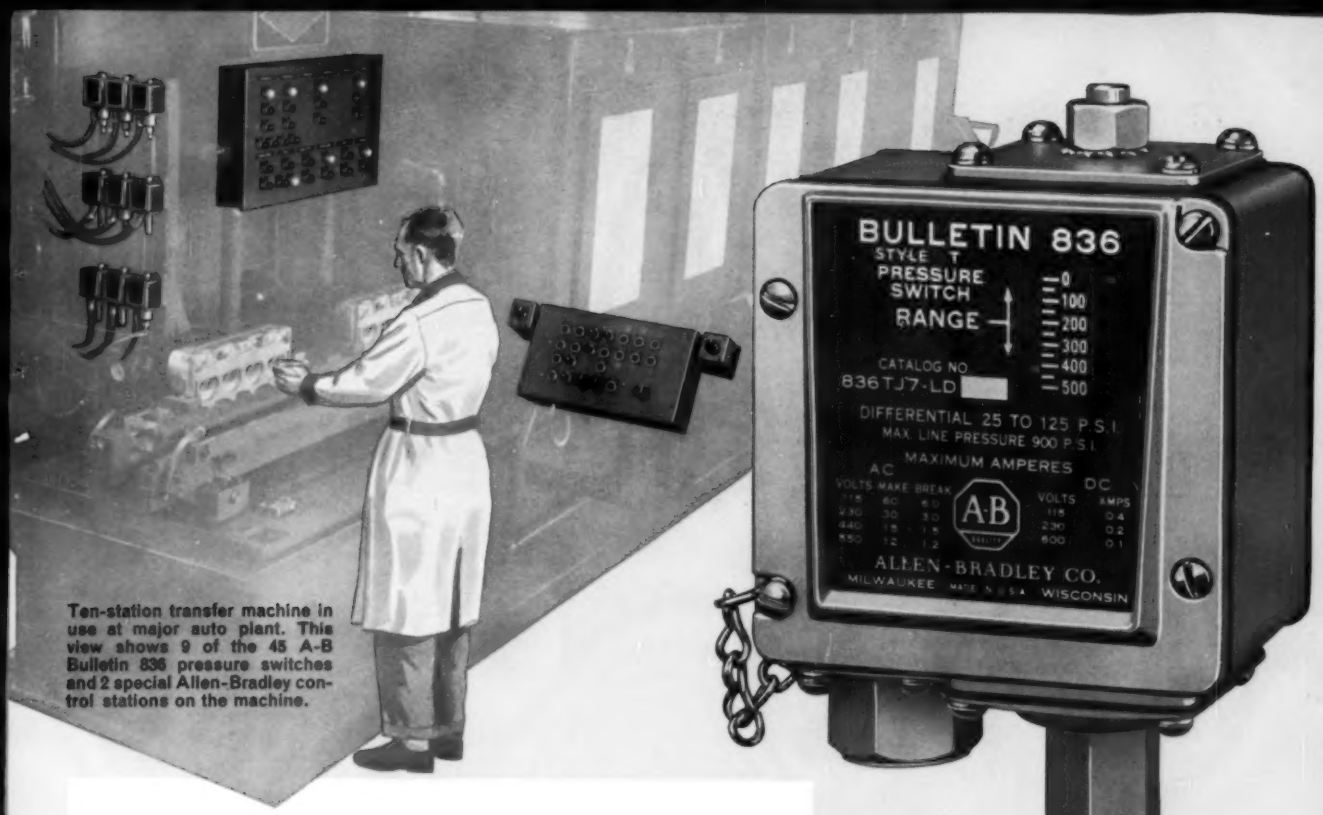
Contracts for more than $2,750,000 have been received from the US Army by Autonetics, a division of North American Aviation Inc. According to Dr Norman F Parker, vice president, Computers and Data Systems, this figure includes a major product engineering contract for continuing work on the Field Artillery Digital Automatic Computer. It was displayed recently at the annual Association of the US Army meeting in Washington.

Hughes Aircraft to Build Mobile Air Defense Vans

Hughes Aircraft Corp has received a $19.5 million contract to manufacture four mobile air-defense command posts at its Fullerton, Calif, plant. The electronic centers, mounted in mobile vans, are part of the Army's "Missile Monitor" network, which permits quick assignment of missile batteries to targets.

Each installation includes a Frescanar unit, the 3-D radar used in surveillance of supersonic targets.

"I finally found his weakness—he hates people!"



Ten-station transfer machine in use at major auto plant. This view shows 9 of the 45 A-B Bulletin 836 pressure switches and 2 special Allen-Bradley control stations on the machine.

ALLEN-BRADLEY

OILTIGHT

Pressure Switches

provide consistent accuracy and maximum reliability

Bulletin 836 Style T
Oiltight Pressure Switch

These rugged Allen-Bradley Bulletin 836 Style T oiltight pressure switches are specifically designed to take the punishment of hard, day-in and day-out industrial use. The die-cast aluminum housing is completely sealed. Oil cannot get in and foul the contacts—even when it flows over the enclosure in a continuous stream. The precision switch mechanism insures extreme accuracy of repeatability. An extremely important feature lies in the "snap action" of this switch—it maintains its normal contact pressure up to the instant of switchover—regardless of how slowly the trip point is approached. Contact chatter—which means unreliable operation—is impossible, and contact life is greatly increased. The contact block has two isolated circuits with one N.O. and one N.C. set of contacts.

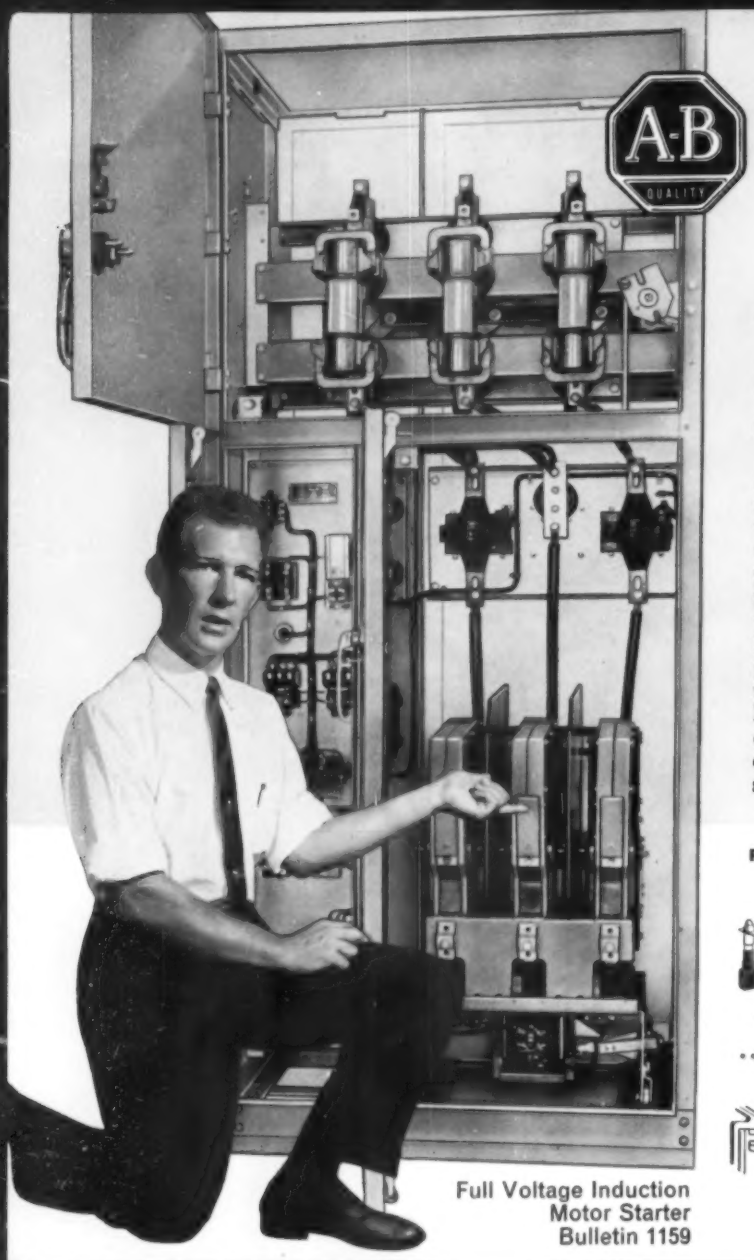
Both the operating pressure and the differential are adjustable. The pressure is externally adjustable with the setting shown on a calibrated scale, and a trip indicator shows the operating point. These A-B *quality* controls are made for operating at pressures up to 5000 psi. Write for full details.

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1319 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ontario



Full Voltage Induction
Motor Starter
Bulletin 1159

The only HIGH VOLTAGE STARTERS

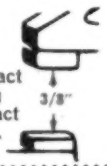
built to provide millions of trouble free operations

An astounding claim but true! The secret of this remarkable operating life of Allen-Bradley high voltage air break starters is found in the extremely short contact travel—*it's only 3/8"*. Thus, pounding and contact wear are reduced to a minimum. In addition, contactors in A-B high voltage starters have only ONE moving part. It's the same simple solenoid design that has proved good for millions of trouble free operations in A-B low voltage starters. And like A-B low voltage starters, the double break, silver alloy contacts never need maintenance. For complete details on Allen-Bradley high voltage starters, send for Publication 6080.

FEATURES OF THE ALLEN-BRADLEY RUGGED SOLENOID AIR BREAK CONTACTOR

ONE MOVING PART
All trouble-causing pivots, pins, and flexible jumpers are eliminated.

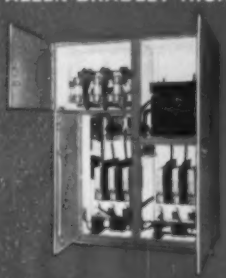
CONTACT TRAVEL ONLY 3/8"
Reduced impact and pounding extends contact operating life.



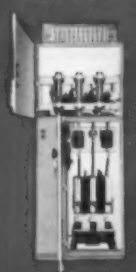
DOUBLE BREAK CONTACTS
of silver alloy completely eliminate the need for contact maintenance.

FAST ARC SUPPRESSION
New blowout design, new arc chutes molded of arc resistant material.

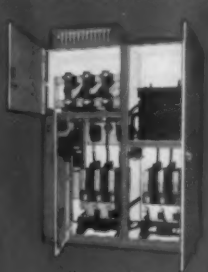
ALLEN-BRADLEY HIGH VOLTAGE STARTERS ARE MADE FOR ALL TYPES OF MOTORS AND ALL TYPES OF SERVICE



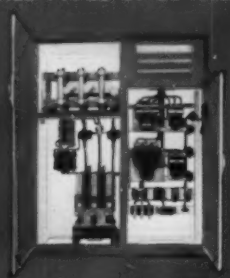
Reduced Voltage
Induction Motor Starter
Bulletin 1172



Full Voltage
Synchronous Motor Starter
Bulletin 966



Reduced Voltage
Synchronous Motor Starter
Bulletin 983



Wound Rotor Motor Starter
Bulletin 1180

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

QUALITY MOTOR CONTROL

12-60-MR

Field Report . . .

New Company Formed In Finishing Field

Custom Abrasive Products Co has been established in Trenton, NJ, for sales and technical services to the metal finishing trades in the Middle Atlantic and New England states. Company will specialize in barrel and vibratory finishing media and compounds as well as pressure blasting abrasives. CAPCO will not sell equipment but will concentrate on applying knowledge of the limitations, advantages, and applications of various media and compounds to the fields of metal cleaning, coloring, preparation for plating and finishing of castings, screw machine products, and stampings.

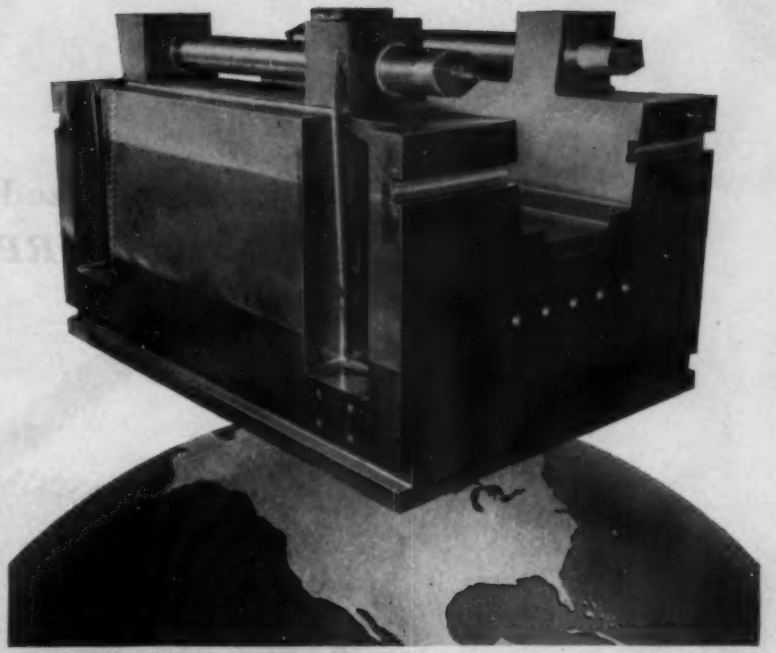
US Industries Sells Division To H W Loud Company

USI has sold the business and principal assets of its Montebello Division to H W Loud Machine Works, headquartered in Pomona, Calif, and a major supplier to the aircraft industry. USI Montebello was formerly a part of the Axelson Manufacturing Co of Los Angeles until the acquisition of Axelson by USI in 1952. More recently it has been a separate division of USI. It's been, over the years, a manufacturer of landing gear and other aircraft equipment.

Casting Engineers Expands

Casting Engineers of Chicago, producer of investment castings and Minicast parts for industrial and commercial applications, has pur-

"Oh, never mind! I'll fix it with a bobby pin."



FINKL TOOK 115,000 POUNDS OF STEEL

35 MILES UP*

TO MAKE THIS 36,000 POUND DIE HOLDER

*The Finkl Process of vacuum degassing steel in the ladle duplicates the atmosphere found at an altitude of 35 miles above the earth.

In this rarefied atmosphere, unwanted hydrogen, oxygen, non-metallic inclusions, and other impurities are literally boiled out of the molten steel, producing cleaner, tougher, stronger, more ductile, flaw-free products.

This 36,000 pound, 40" x 44" x 64" die holder is used in a heavy duty press. It was made of Finkl FX analysis, Temper 4, and finished machined in our shops.

All Finkl die blocks and hot work die steels are made from vacuum degassed electric furnace material produced in our own melt shop. Because of the clean, greatly improved qualities, you get more forging production, less downtime due to breakage, and savings in fewer tool regrinds.

You get more from Finkl in quality, continuing research, and engineering service. Call your Finkl representative for your forging, hot work die steel, and die block needs.

HOT WORK STEELS · DIE BLOCKS · FORGINGS · ELECTRIC FURNACE STEELS

SPECIFY FINKL DIE BLOCKS FOR "IMPRESSIONS THAT LAST"

A. Finkl & Sons Co.

2011 SOUTHPORT AVENUE • CHICAGO 14, ILLINOIS

Offices in DETROIT • CLEVELAND • PITTSBURGH • INDIANAPOLIS • HOUSTON ST. PAUL • COLORADO SPRINGS • SAN FRANCISCO • SEATTLE • BIRMINGHAM • KANSAS CITY BOSTON • LOS ANGELES Warehouses in CHICAGO • DETROIT • BOSTON • LOS ANGELES

◀ CIRCLE 281 READER SERVICE CARD

CIRCLE 282 READER SERVICE CARD

An Iguana will be recognized...
by a *HERPETOLOGIST*
(specialist in reptiles)

potential savings will be recognized... by a *LINCOLN* man

(specialist in arc welding)

ANY IDEA which can cut welding time from 90 to 45 minutes on missile beams for the Army is darned important! That's exactly what happened in a New Jersey plant.

A LINCOLN Field Engineer was walking through the plant with the Welding Foreman and Plant Manager. Naturally he was interested in watching the welding operation on missile beams. A thought crossed his mind. He asked if he could demonstrate LINCOLN Jetweld electrodes on the beams. He rolled up his sleeves; took some Jetweld from the trunk of his car, and cut the welding time from 90 to 45 minutes. The weldors on the job did the same.

That afternoon the Field Engineer finished his plant tour and spotted some applications for Fleetweld 37 electrodes for welding sheet metal on trailer bodies. Again welding time was cut almost in half, cleaning time reduced and overall costs slashed to the bone.

Quite a day's work for one Field Engineer . . . but putting PROFIT into welding operations is part of each LINCOLN man's job. You can count on him to show you . . . not tell you how to cut costs and make more money.

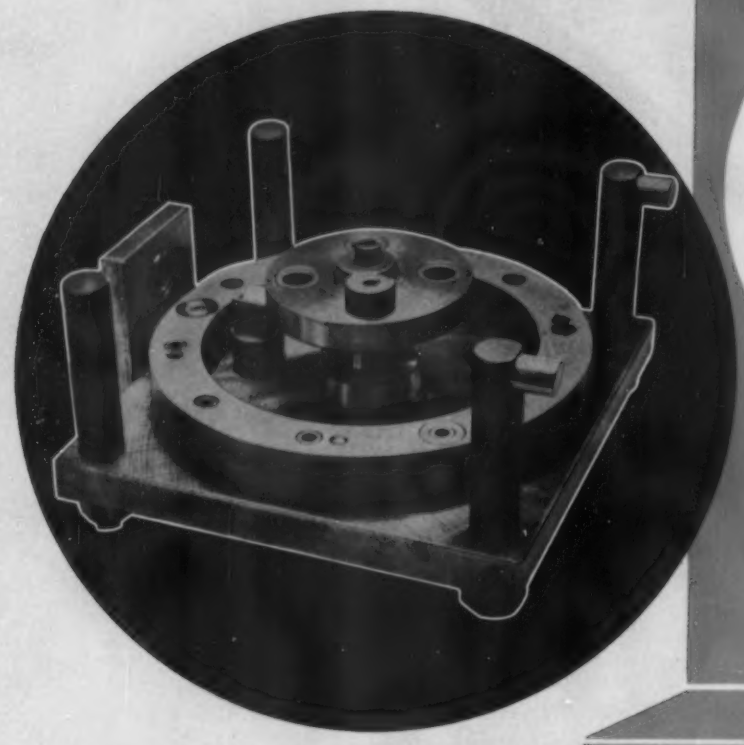
That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

Call your LINCOLN Field Engineer today.

THE LINCOLN ELECTRIC COMPANY
Dept. 1640 • Cleveland 17, Ohio

LINCOLN WELDERS

THIS DRILL JIG NOW MADE IN



LO-AIR

*Low Temperature — Air Hardening**

TOOL and DIE STEEL

Reduces Grinding and Machining Time

LO-AIR, the tool and die steel that features easy machinability and least distortion in hardening, permitted up-grading of steel in this case—as reported by Mr. Joseph Carrera, Plant Superintendent of Quality Tool and Die Company, Hoboken, N.J.—because savings in time more than made up for the difference in material cost.

The drill jig illustrated above required much less heat treating expense—and 25 hours less jig boring and jig grinding time with LO-AIR. It was formerly made of cold rolled machinery steel, which had to be carburized to provide necessary wear resistance. Also, there was a great hazard of cracking in quenching this part. LO-AIR also solved these problems.

For complete data on this and other LO-AIR applications, write for Performance Report No. 23. Also, we will gladly send you a copy of our 12-page LO-AIR brochure which contains full information on this time and money saving tool and die steel. Complete stocks available. Call our nearest warehouse or sales office for quick delivery.

**U.S. Pat. No. 2,355,224*

UNIVERSAL CYCLOPS
STEEL CORPORATION
EXECUTIVE OFFICES: BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

Field Report . . .

chased Jelrus Precision Corp of New York. Jelrus, which will continue to operate under its own name, is known for production of investment castings in a wide alloy range, particularly in the missile and electronics field.

Willys Gets $9 Million Jeep Order

Two contracts adding up to more than $9.7 million for 5228 Jeeps and spare parts have been received by Willys Motors, Toledo, from Army Ordnance. One order calls for 1228 military units for the US Marine Corps and the Venezuelan Army (under the military assistance program); second contract is for 4000 Jeep Universals for the Turkish Army.

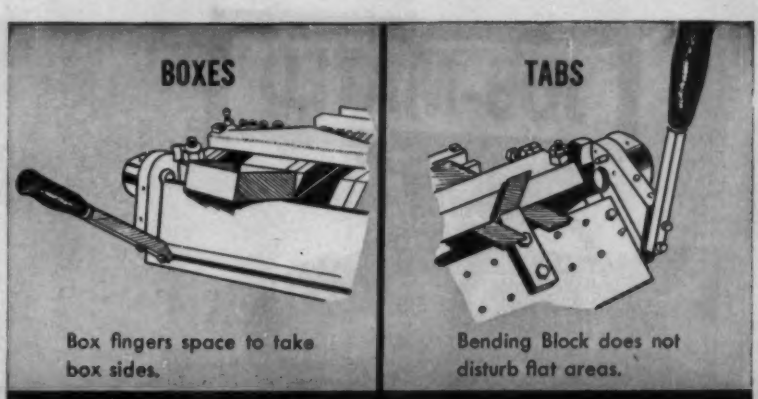
Vulcan Iron Moving South

In November, Vulcan Iron Works, 108-year-old Chicago manufacturer of pile-driving and road-building equipment, will move all of its manufacturing facilities and offices to Chattanooga, Tenn. The 70,000 sq-ft plant now under construction represents an investment of more than $1 million. "Economic factors and better proximity of major suppliers" were reasons given for the move.

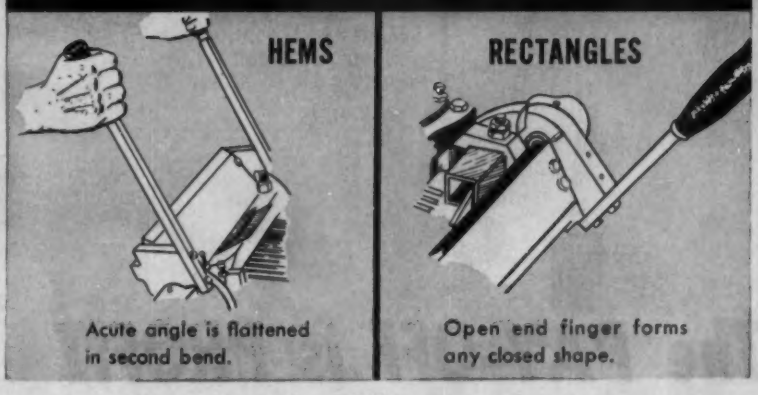
May-Fran Bought by Cleveland Engineering Firm

All assets of May-Fran Manufacturing Co, producer of belting, conveyors, and special purpose equipment and machinery, have been purchased by H Fischer & Associates, Cleveland engineering firm that offers a variety of engineering services from design to plant layout.

"Pardon me, Miss, are my seams straight?"



HOW TO FORM... Sheet Materials



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The Di-Acro Brake is a six-in-one precision metal working machine simply tooled for a variety of jobs. Ten models in 6", 12", 18" and 24" widths handle up to 16 gauge mild sheet steel.

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Wasted overhead space in your plant is eating up profits! Make it pay off by installing an overhead traveling hoist to free valuable floor space and aisles for production or storage, cut handling costs, and increase overall plant efficiency.

To give long, economical service, the hoist must be matched to the job. At Shepard Niles, we specialize in providing **"Job-Mated"** hoists that have the ideal combination of capacity, clearance, speed and controls needed to match performance to precise job conditions. Custom built to your most exacting specifications.

Whatever your requirements, check first with Shepard Niles—you're sure to find the **right** hoist for the job among the thousands of types and sizes available.

To find out how Shepard Niles **"Job-Mated"** hoists will pay off in your material handling operation, send for a free descriptive bulletin, and ask to have a Shepard Niles representative call.

Balanced Drive Hoists from 250 lbs. to 20 tons

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Field Report . . .

Salem-Brosius Takes Over Alloy Mfg Corp

Alloy Mfg Corp, Horning, Pa, and its Freitag Division at Akron, Ohio, will be incorporated into Salem-Brosius Inc, Carnegie, Pa. Immediately, sales, engineering and estimating will be taken, with some manufacturing operations to be combined at a later date.

Nuclear Tube Buys Crowell

Nuclear Metals Inc of Concord, Mass, has acquired 100% of the stock of Crowell Tube Co, Lexington, Mass, maker of small-diameter metal tubing for the electronics and aircraft industries. Crowell will continue to operate as a separate firm.

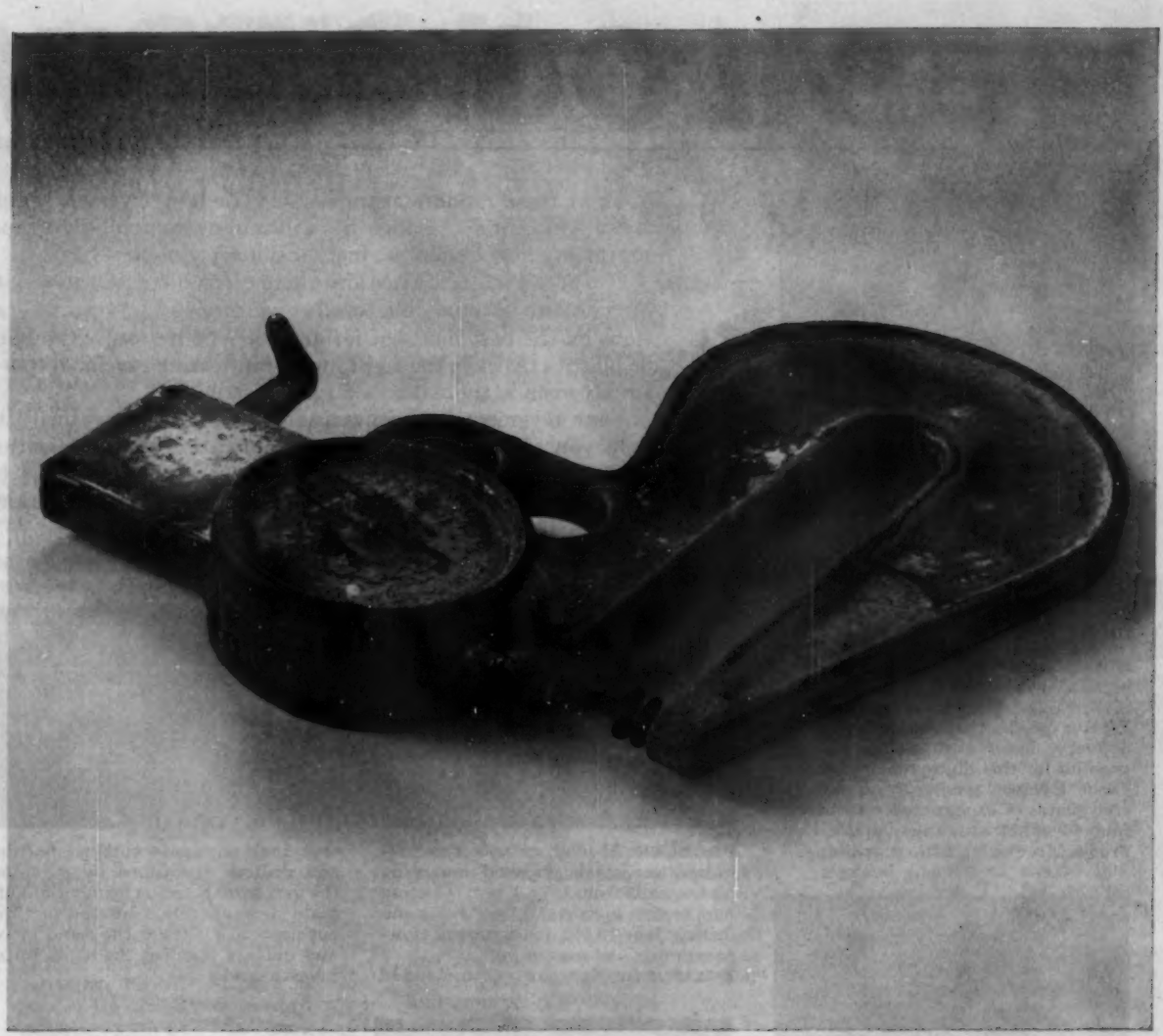
Vulcan Detinning Expands

Vulcan Detinning, a division of Vulcan Materials Co, will build two new plants, one in Los Angeles and one in Houston. Addition of these plants will extend the Division's operations virtually from coast to coast.

New Plant for Federal Pacific

Federal Pacific Electric Co, maker of electrical equipment and electronic components, has broken ground for a 175,000 sq ft plant near Chicago's O'Hare International Airport. The plant, when completed in 1961, will contain offices and warehousing for Federal Pacific and Cornell-Dubilier, and manufacturing operations for Economy Fuse Corp and Economy Screw Corp — suppliers to Federal Pacific. The plant will be located in a new $85 million industrial park under development at Des Plaines, Ill.

"I just need enough to tide me over till I can find someone to sell it to me for less."



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This Federal thickness gage — baked to a crisp, dial obliterated, crystal gone, hand bent, parts missing, was still on the job checking hot sheets in the rolling department when it was returned for renovation.

No accident that it could still do its job under conditions that would have long since retired a lesser gage. Proper design and good workmanship give Federal gages the workhorse durability that makes them regularly outperform and outlast other gages.

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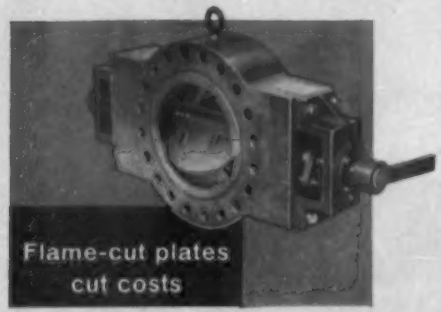
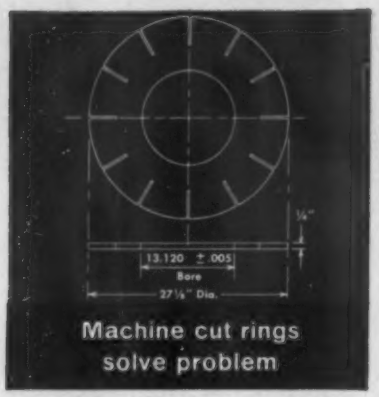


HIGH REJECTS: Use of flat steel castings for valve bodies, with I. D. ranging from 4" to 60", accounted for increases in costs for this manufacturer. Pattern costs rose because of numerous changes . . . rejects were high due to porosity and other casting faults that showed up only after machining.

HIGH QUALITY: Ryerson recommended using flame-cut plates ranging in thickness from 1" to 8". Results: greater production flexibility, faster delivery, lower cost and a stronger product for this high-pressure service. Tight Ryerson quality control delivered plates of exceptionally clean surface to exact thickness of finished product, requiring little machining.



PLATES REQUESTED: Ryerson was asked to bid on supplying ¼" Type 410 stainless in 27½" square plates. Material was to be used for orifice plates for 16" burner, subjected to elevated temperatures.

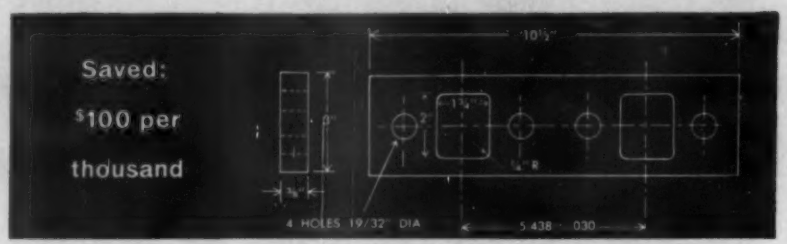
RINGS RECOMMENDED: Going beyond material specs, the Ryerson representative found that the customer intended to cut plate into 27¼"-diameter rings with 13.120" bore—and then mill 12 slots in outer diameter for expansion relief. Knowing the application, Ryerson recommended supplying machine-cut rings in which slots could then be punched rather than milled. Production savings enabled switching to Type 304 at less cost than Type 410 with slots milled.

Look at these random examples and see how Ryerson Metalogics sparks real savings by continually searching for and suggesting new materials, methods and techniques.

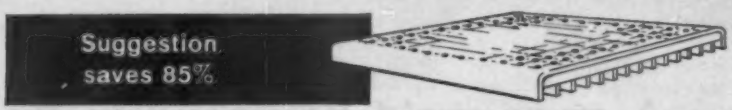
The broadest experience anywhere combines with the widest range of stocks available to offer you unbiased recommendations on the best material for any job—be it steel, aluminum or plastics. Always the right metal-fabricating machine, too—for Ryerson is the nation's largest distributor.

Your Ryerson representative is "Metalogics-trained" to help you *value-analyze* selection, fabrication and application problems. Get his constructive ideas soon, and see how he can help you select and apply material from our vast stocks. It's the "Metalogical" thing to do.

**The Ryerson science of giving optimum value for every purchasing dollar.*



PROBLEM: Muffler manufacturer required accurately finished mounting plates made from ⅜" x 3" bar. Cutting bars to size, burning 1¾" x 2" holes and drilling four 19/32" holes proved time-consuming and expensive.
SOLUTION: Ryerson recommended that they eliminate cutting, burning and drilling operations by stamping the part from Ryerson forming-quality plate. One operation instead of three cut costs $100.00 per thousand pieces and quickly justified the small initial investment in dies.



ASKED FOR: Customer wanted 1" hot rolled plate to cover about 80' of 24" open trench. Plate was to be cut into 24" x 27" segments—each containing 900 ¾" holes to filter the product.
RECOMMENDED: After studying application and cost, Ryerson recommended a design combining perforated light plate, formed to channel shape, and grating for structural support. Ryerson experience and imagination saved 85% of the original cost.

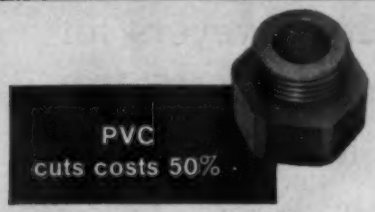
Soft touch on fabricating sheets

THE NEED: Cold rolled sheets that would take severe forming and retain smooth, dull surface for high lacquer finish. Sheet quality was found on inspection to vary widely from one shipment to the next, causing variations in forming and finishing operations . . . high reject rate.
THE ANSWER: The Ryerson representative showed how our stringent quality controls would assure consistent quality on every shipment so that forming and finishing could be standardized for better results . . . lower production cost figures.

ACTION

BEFORE: Job shop was using MT 1015 tubing in the manufacture of this coupling. Machinability was satisfactory, but rising costs of operation led to a search for ways to economize.

AFTER: Careful study by the Ryerson representative brought about a change in material. He recommended using Ledloy® 170 tubing, which increased machining speed to 170 s.f.m. and stepped up production 30%. Ryerson's stocks include the widest range of fast machining alloys—types and sizes to fit your every need.

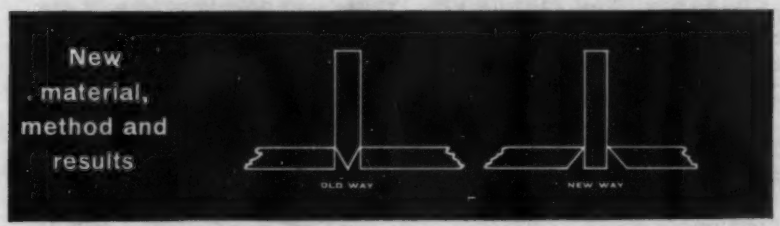


OLD WAY: A screw machine shop used nylon in the manufacture of nipple adapter and coupling nuts—until a Ryerson representative came on the scene.

NEW WAY: At his suggestion, they changed to Ryertex-Omicron PVC—cut costs 50%. PVC machined better—to closer tolerances, with improved finish . . . ran faster without "gumming." Note exact cutting of threads and barbs. Threads fit perfectly.

SEARCH: Complicated machining of a carbide grade gear shaft included cuts up to ½". It was discovered that required machining was too slow with the steel chosen for the job.

ANSWER: Rycut® 40 was recommended by the Ryerson representative. This free machining alloy fit the situation perfectly. The company found that Rycut 40 machined at 250 s.f.m., gave a better finish, increased tool life, and lowered total per-piece cost. An alloy in the Rycut series may well lower your costs.



OLD: Rows of vertical aluminum grid members were attached to an aluminum base plate by notching the grid members and welding. (2024-T3 aluminum plate was used.) However, upon cooling, welds fractured—causing a high reject rate on this assembly.

NEW: A Ryerson representative suggested undercutting the base plate (as shown) instead of the grid members. This exposed a greater area to heat and permitted a larger deposit of weld material. Another Ryerson suggestion: change material to 5052-H34 aluminum, which responds better to welding operations.

5-DAY LIFE: The sheaves that guide the enormous digging buckets of underwater dredges take a very severe load. Bronze bearing in the sheaves had to be replaced every four or five days.

5 MONTHS, SO FAR: After discussing the problem with a Ryerson man, the chief engineer decided to try a bearing made of Ryertex. The change was made, and five months later hardly any wear was noticeable! With its low friction coefficient, Ryertex is nonbinding, even on itself.

2 metalworking machines for the price of 1

A fabricator of stainless steel kitchen equipment was recently in the market for a new squaring shear. The one under consideration had a gap-type frame which would enable him to do an important notching operation—necessary for certain sink tops. After careful study, a Ryerson machinery specialist recommended *two* pieces of equipment instead of one at no increase in total cost. The first, an underdriven shear. The second, a universal-type sheet metalworking machine that would do the required notching, plus many other jobs—adding versatility to the entire operation.

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STEEL—carbon, alloy, and stainless steel—bars, structurals, plates, sheets and strip, tubing, etc.

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MACHINES AND ATTACHMENTS

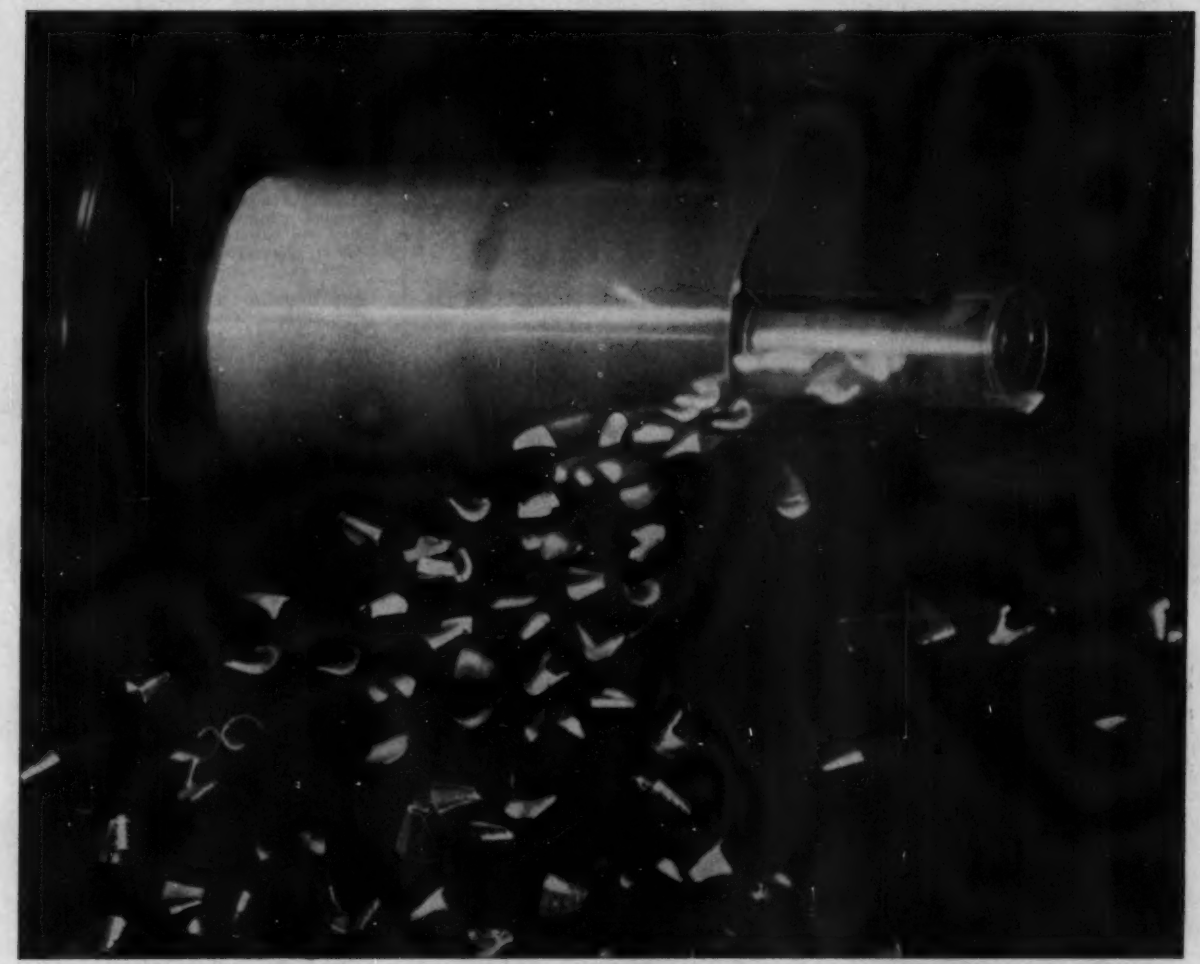
1 LIGHT-HEAVYWEIGHT MACHINE TOOLS—*Rockwell Manufacturing Co, Walker-Turner Division, 400 N Lexington Ave, Pittsburgh 8, Pa.* 52-page catalog WT-50 Rev 3 illustrates and describes complete line including drillpresses, grinders, cutoff machines, bandsaws, and belt and disc surfacers. Provides specifications and data on accessories. New tools covered include a 20-in. power feed drillpress; 15-in. drillpress with 4-5/16-in. spindle travel; 14-in. Hi-Speed drillpress; and belt and disc finishing machine.

2 CONOMATIC-PILOT LATHES — *Cone Automatic Machine Co, Pilot Division, Windsor, Vt.* 6-page illustrated brochure provides detailed information on Model KU automatic multi-cycling copying lathe. Features include an extremely sensitive tracing system; constant and complete control over tool movement; manual or fully automatic operation at any point in the production cycle. Capacity of the KU-8 and KU-10 is 35 in.; capacity of the KW-8 and KW-10, 54 in. Swing over bed (for all) is 17-¼ in.; over cross-slide, 10½ in. Spindle speeds of the KU-8 and KW-8 are 510 to 2650 (high range) and 255 to 1325 (low range); for the KU-10 and KW-10, 350 to 1800 (high range) and 175 to 900 (low range).

3 UTILITY PRESSES—*Lempco Industrial Inc, Machine & Tool Division, 5490 Dunham Rd, Bedford, Ohio.* 4-page bulletin pictures and describes platen and shop presses, manually operated and electrically driven, single and double action. Designed for die tryout, forming, bending, straightening, fabricating, assembling, or compression molding and laminating, the 700 Series of Lempco presses are general utility models ranging from 25 to 150 tons capacity.

4 MACHINE TOOL FOR AUTOMATIC ASSEMBLY—*Ferguson Machine Corp, 7818 Maplewood Industrial Court, St Louis 17, Mo.* 8-page catalog 602 contains information on a standard rotary transfer machine which includes parts placing motions at the working area on the dial. User merely adds chucks, collets, or other minor parts holding devices designed for

"The boss said to watch you—that you're a smooth operator!"



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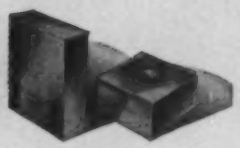

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his operation and changes setup for a new production run as he would apply special fixtures to a production mill or screw machine. Dimensions and design data are given for standard cam actuated work station mechanisms. Case histories included.

5 CUSTOM MACHINES—*Frauenthal Division, Kaydon Engineering Corp, Muskegon, Mich.* 4-page 900 Series illustrated bulletin gives information on production machines for contour and conventional grinding, boring, and turning. Describes the custom designing service of Frauenthal in providing vertical machines in many configurations to meet customer requirements, using building block construction. Standard and optional features, including tracer control and numerical control, are described.

6 GEAR FINISHERS—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* 8-page bulletin 870-60 covers new line of Mark II machines. Discusses the three methods of shaving that can be used: underpass, transverse, and modified underpass, and shows how setup procedures are simplified. Also covered are two attachments for these units—one for crowning, tapering, or crown-taper shaving, and the other for sensing excess stock on the workpieces so that the machine will shut down to protect the cutters. These machines finish external spur and helical gears, and internal gears.

7 TURRET INDEXING MACHINE CHASSIS—*Swanson-Erie Corp. 314 E Eighth St, Erie, Pa.* 8-page brochure describes operating features of Swanson Series H and Series K; lists complete physical dimensions and specifications as well as available accessories. Both series are designed to provide intermittent motion for multiple station automatic assembly and processing operations and are manufactured as basic units around which special automatic machines can be developed. All units feature an extension to the main index camshaft which provides for positive mechanical actuation of primary or auxiliary tooling, limit switches, pilot valves and related devices.

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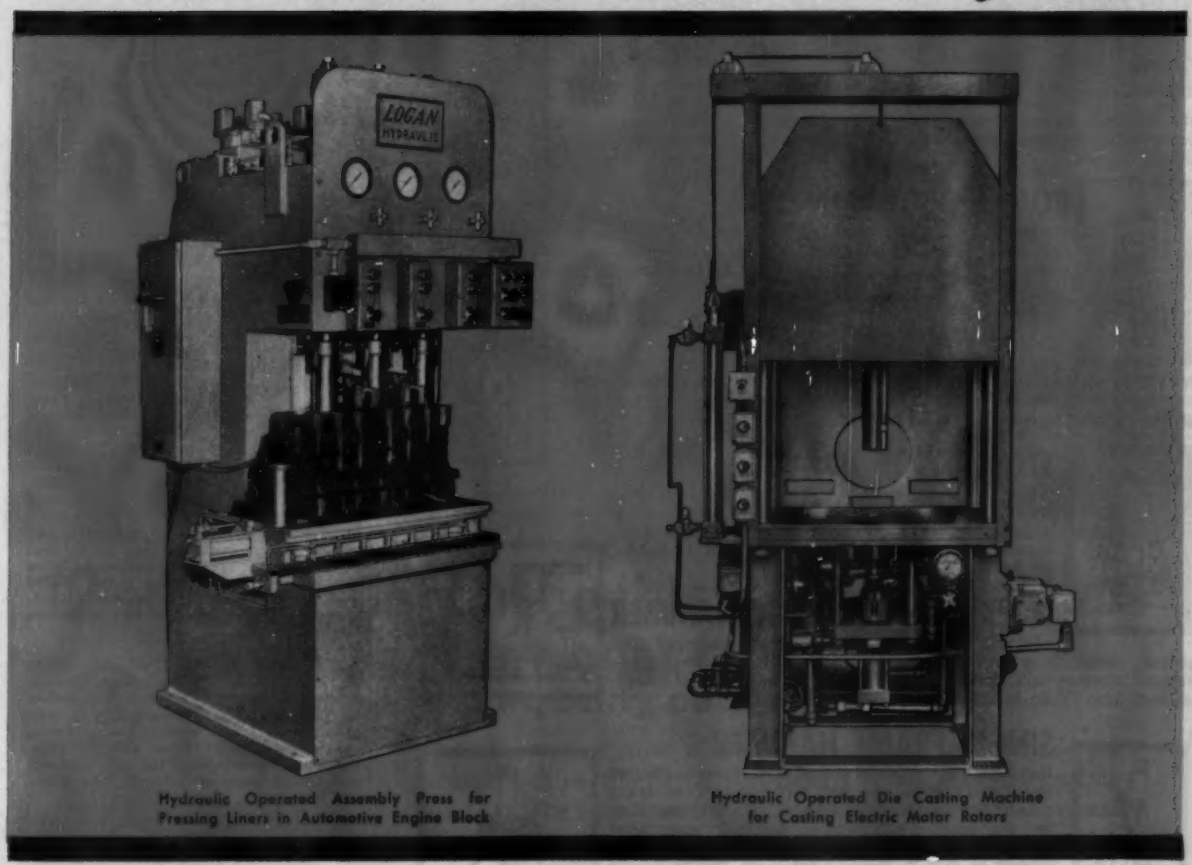

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An air-operated, piston-lift, gravity-drop hammer designed especially for operations common to coining presses, compacting presses, strap hammers, pneumatic drop hammers, etc. May be operated manually, semi-automatic or completely automatic. Electric control system. Sizes 500 lbs. to 5000 lbs. Ask for Bulletin No. 73-L-7.

BOARD DROP HAMMER

The best of the board drop hammers. Belt or motor drive. Unique board clamp arrangement and improved roll design promcte better board life, result in less down time. Unusual strength and rigidity. Sizes 100 lbs. to 5000 lbs. Ask for Bulletin No. 90-L-9.

CECOSTAMP

An air-operated impact drop stamp that produces a controlled blow or a "squeeze" instantly, at the will of the operator. Gives a permanent set to all the formable metals—even high strength alloys. Popular in iron foundries as inexpensive, highly productive tool for restriking malleable castings. Sizes from 21" x 18" platen area to 120" x 120" platen area. Ask for Bulletin No. 30-L-5.

STEAM DROP HAMMER

Designed to produce forgings at lowest cost per piece. Unique differential porting on Model "E" makes for the most efficient use of steam or air—greatest economy of power. Unusual strength and rigidity reduces down time, maintains alignment, increases production. Sizes 1000 lbs. to 16,000 lbs. Ask for Bulletin No. 55-L-4.

PNEUMATIC HAMMER

Popular motor-driven hammer with self-contained compressor, for flat-die or blacksmithing operations. Ideal for tool dressing, for research laboratory work, etc. An exceptional forging tool, independent of steam or air lines. Sizes 200 lbs. to 5000 lbs. Ask for Bulletin No. 16-L-9.

SINGLE FRAME HAMMER

High frame provides greater working space. Specially designed forged alloy steel dies ease stock manipulation. Power-saving cylinder cuts operating costs. Preferred for forging large discs and rings, upsetting high stems, etc. Ram guides supported on 5 sides. Sizes 750 lbs. to 6000 lbs. "Power/trol" power-assist controls on 2500 lb. hammers and larger. Ask for Bulletin No. 1-L-4.

DOUBLE FRAME HAMMER

Large working space for special or routine jobs. Well suited for making large rings, cogging and drawing out toughest alloy steels and high temperature "exotic" metals, making large axle forgings, etc. Heavy 15:1 anvil increases blow effectiveness. Sizes 2000 lbs. to 24,000 lbs. "Power/trol" power-assist controls on 3000 lb. hammers and larger. Ask for Bulletin No. 74-L-7.

THE IMPACTER & CECOMATIC FORGING

The revolutionary Chambersburg Impacter forges by means of horizontally-opposed rams striking the stock simultaneously from both sides. This new concept of the forging process makes possible the continuous, automatic production of drop forgings. Fully described in Bulletin No. 87-L-9.

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When it's a vital part, design it to be FORGED

Free Literature

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TOOLS AND ACCESSORIES

8 PLASTIC MOLD AND DIE CAST DIE BASES—*Columbia Engineering Co. 113-119 Sussex Ave, Newark 2, NJ.* 26-page 1960 illustrated catalog gives prices and design specifications for standard and special plastic mold and die cast die bases. Also lists the various steels and machining services available for plastic injection, compression, and stripper mold bases and for die cast die bases.

9 NUMERICAL CONTROL SYSTEM —*Diehl Manufacturing Co, Finderne Plant, Somerville, N.J.* 8-page brochure describes the newly developed Singer system advantages of which include production accuracy of up to ±0.0002 on a 40-in. worktable, and flexibility and economy of operation achieved through modular design. Product data and illustrations are provided on all of the modular components which make up the system. These include a tape reader, distributor, digital analog converter, notch phase discriminator, mechanical module, position indicator control, and servo-micrometer. One section covers the operational sequences of the system from preparation of input data to the completion of the entire work program.

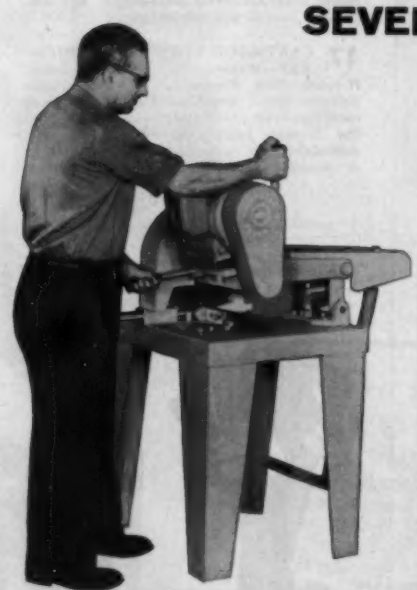
10 HOLE PUNCHING AND NOTCHING UNITS—*Punch Products Corp, 370 Babcock St, Buffalo 6, NY.* 16-page catalog A illustrates and describes complete line of Unipunch Series A hole punching units for punching up to 3-in.-dia round and shaped holes in up to ¼-in.-thick material (Series AH up to ½-in.-thick material). Unipunch Series A notching units for corner, edge, vee, and shaped notches shown in the catalog can be used in the same setups with Unipunch Series A and AH hole punching units. All of these Unitized units have the same standard 8⅝-in. shut height and 3½-in. die height.

11 TOOLS—*Fastcut Tool Co. 25425 Mound Rd. Warren, Mich.* 32-page catalog 4 provides detailed information on HSS end mills, keyseat cutters, combined drills and countersinks, reamers, counterbores, in 51 types and 794 sizes. Catalog is photo-indexed for easy reference and several pages of technical information are included.

"'Candy, cigarette, peanut, and coke' is hardly the answer we want when we asked what machines you could operate!"

12 seconds per cut on this 2-inch steel bar!

SEVER-ALL MODEL 1-A gives high-quality cuts at low cost



Even the newest super alloys can be cut at 3 to 6 seconds per square inch on the Sever-All Model 1-A dry abrasive cutting machine. The burn-free slices of hardened steel shown above are typical of the cuts you'll get on almost any metal. *You get this speed and quality for an investment of approximately $500!*

You get big capacity, too, with the Model 1-A—up to 2" square solids, 3½" O.D. pipe and tubing, 3" angle iron and 4" channels. You can cut practically any metal. On top of that, wheel oscillation—an "exclusive" in this price range—provides cooler cutting, longer wheel life.

The Model 1-A is so easy to use, too. Wheel selection is simple—just two types of wheels do *all* your Sever-All cutting jobs. Minimum set-up time required.

You can get immediate delivery from your Sever-All distributor. ***Write*** us for his name — or ask for **Bulletin DH-106** for details on the Sever-All Model 1-A.

SEVER-ALL ABRASIVE CUTTING MACHINES

ACCO

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

These are the new "SS" (Special Shape) Mounted Wheels now available through your Chicago Wheel supplier. You select from 6 Special Shapes instead of 200. You choose from 30 sizes in 3 specifications (see below). Best of all, you get *immediate delivery* of the finest quality mounted wheels. Research and industry practice have shown that the new "SS" Series Mounted Wheels cover 96% of all portable off-hand grinding needs. Ask your supplier for "SS" Chicago Wheels.

SPECIFICATIONS OF NEW "SS" MOUNTED WHEELS FOR IMMEDIATE DELIVERY

A	General purpose grinding	All sizes
B	Die grinding, high rockwells; hardened tool steels, die steels	All sizes
C	Castings, iron and steel	Selected sizes

WRITE for your free copy of Bulletin SS-101 which fully illustrates and prices the new SS Series of CHICAGO Mounted Wheels.

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12 SPECIAL CUTTING TOOLS —*F & D Tool Co, Three Rivers, Mass.* 45-page illustrated catalog lists complete lines including plain milling cutters, light and heavy; helical milling cutters; side milling cutters, staggered tooth, half side, interlocking; metal slitting saws, hollow ground, side chip, staggered teeth.

13 GAGES—*Cadillac Gage Co, PO Box 3806, Detroit 5, Mich.* 40-page cat- and ring gages. Also included is an 8-page section on company's Pin-Chek gages manufactured in a complete range of sizes for fast, accurate surface plate inspections. alog illustrates, describes, and prices complete line. Provides specifications and sizes of thread plug and ring gages, cylindrical plug and ring gages, and pipe thread plug

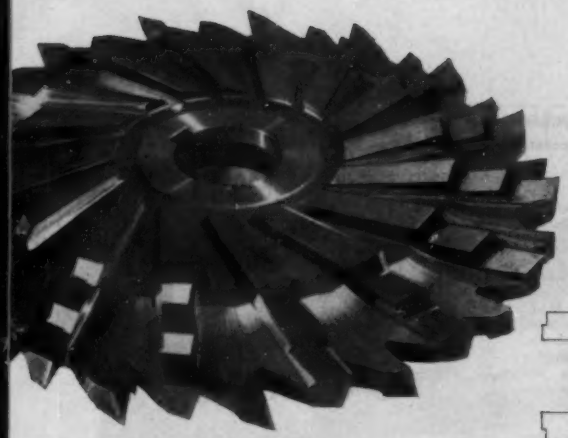
14 THERMOCOUPLES AND PYROMETER ACCESSORIES—*Bristol Co, Waterbury 20, Conn.* 56-page bulletin P1238 contains a users' manual outlining possible applications of Bristol pyrometer accessories, a buyers' guide which catalogs specifications of accessories, and a third section giving thermocouple calibration data.

15 BRUSHING TOOLS — *American Brush Manufacturers Association, 1900 Arch St, Philadelphia 3, Pa.* 17-page brochure provides general information on industrial brushes in question and answer form, and pictures and describes wide range and variety of applications.

16 MILLING CUTTERS—*Valenite Metals, Division of Valeron Corp, Box 805, Royal Oak Mich.* 24-page catalog, "The V M U System of Milling," lists 500 throwaway insert milling cutter styles and sizes. Covers complete line of cutter bodies, cartridges, inserts and accessories for milling cast iron, steel, aluminum, and nonferrous metals. Cutter body and cartridge details; insert shapes; lead angles and rakes; standard drive dimensions; and accessory details are illustrated.

17 CARTRIDGE-TYPE TOOLHOLDERS—*Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* 4-page bulletin C-660 describes the 18 standard cartridge-type toolholders that comprise the Wesson Insert-Cartridge System for assembling an unlimited variety of single or combination boring, facing, and recess-

"Before you leave for your new job, I'd like to say it's been a pleasure working with you, but it hasn't."

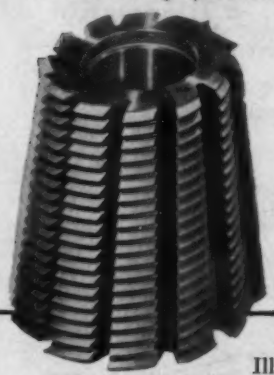


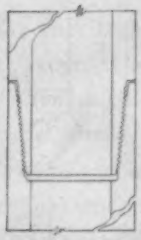
A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.

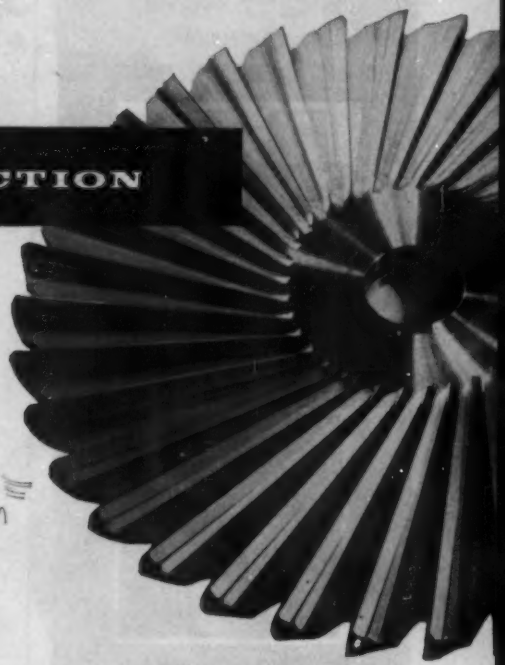
This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

HOW TO GET THE MOST OUT OF HIGH SPEED PRODUCTION MILLING MACHINES

This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.







A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

Illinite® Special Milling Cutters, like those shown here, speed production and cut costs two ways:

(a) Illinois Tool applied metallurgy assures long, efficient tool life through proper material selection, forging and heat treatment *tailored to your specific application.*

(b) Illinois Tool engineering job-tailors your special milling cutters for maximum efficiency. ITW tool designers often combine several machining operations into a single cutter or gang, with consequent savings of considerable time per piece. Specially designed tools such as these also assure improved accuracy *since accuracy is designed into the tool,* and is not dependent upon several separate operations.

Why not get the most from *your* high speed production machines. Ask your Illinite distributor about job-tailored milling cutters today! Remember, he also carries a complete stock of standard cutters for prompt delivery.

Write today for this helpful new booklet on Metallurgy in Tool Design and Production.

ILLINOIS TOOL WORKS

TOOL & INSTRUMENT DIVISION

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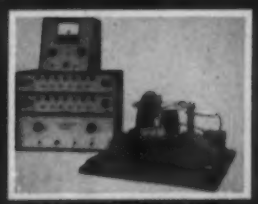
MICROtolerance Measurements



High Reliability High Speed Sorting

Positive Continuous Machine Tool Control

For complete information on the Versatile MICRO*trol*® type 160 line of Electronic Gaging and Control Equipment...

Call your Cutler-Hammer Sales Engineer or write:

AIRBORNE INSTRUMENTS LABORATORY
DEER PARK, LONG ISLAND, NEW YORK
A DIVISION OF CUTLER-HAMMER, INC.

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ing tools. Typical combination tools illustrated, complete dimensional specifications provided, and characteristics of different grades of carbide inserts used are discussed.

18 SAFETY TOOLS—*Ampco Metal Inc, Box 2004, Milwaukee 1, Wis.* 4-page bulletin ST-5 pictures and describes stock numbers and sizes of such tools as wire brushes, hammers, scrapers, pliers, shovels, wrenches. Non-sparking, non-corrosive qualities of these tools make them desirable where tool sparks might cause fires or explosions.

19 MAGNETIC RECORDING AND REPRODUCING HEADS—*Minneapolis-Honeywell Regulator Co, Industrial Systems Division, 10721 Hanna St, Beltsville, Md.* Specifications DS 3301a and DS 3400 provide complete specifications covering magnetic recording and reproducing heads and drum heads. Included are formulas for determining the correct magnetic heads, playback voltage, and turns and gap. Application data sheet is included.

20 CLEANERS AND LUBRICANTS—*Macco Products Co, 9210 S Sangamon St, Chicago 20, Ill.* New products selector brochure tells how to select cleaners, cutting lubricants, drawing compounds, rust preventives, forging compounds, and extrusion lubricants, and lists 46 different compounds in these categories to simplify selection by pin-pointing to specific applications. Selector includes compounds for all types of metal and processing conditions.

21 GAGING INSTRUMENTATION — *Measurement Control Devices, PO Box 505, Camden, N.J.* Illustrated catalog G-100 describes in detail the systems and components available for the continuous indicating and monitoring of minute changes in dimensions for control usages. Describing bearing, comparator, and height type gaging heads, the brochure also covers mounting stands as well as amplifier and display units for use in closed loop servo indicating systems.

22 CARBIDE TIPPED SAWS—*W F Meyers Co, Bedford, Ind.* Catalog illustrates and describes Meyco line. In addition to many new items in line of carbide tipped precision, rip, all-purpose, metal-cutting, combination planer and portable blades, a new selection of thin-rim saws is offered.

"I don't suppose you have them in a toeless sandal?"

THE REMARKABLE MARKER • • • FOR REMARKABLE PRODUCTS

MATTHEWS Airgrit®

Marks gently permanently on

STAINLESS
ALUMINUM
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"Airgrit" marks the hardest, most polished surfaces with not much more than a breath of air.

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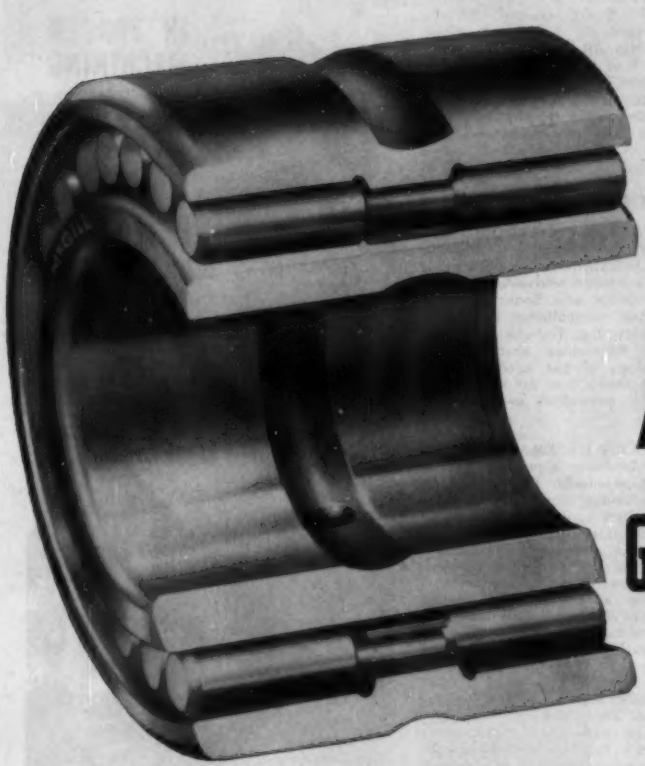
FOR EXTRA LOAD CAPACITY IN MINIMUM RADIAL SPACE use



McGILL®

GUIDEROL® BEARINGS

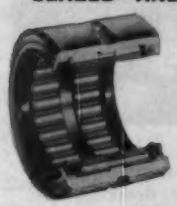
MT SERIES

Here is a compact bearing with high load-carrying capacity. Its full complement of race-width rollers is guided by an integral rail in the outer race bore, providing strength and skewing limitation that prevents binding under controlled misalignment. Rollers are guided at any operational angle from horizontal to vertical — self-cleaning through open ends. Available with or without separate inner ring in shaft sizes from ½" to 9¼". Dimensionally interchangeable with ordinary heavy duty needle bearings.

CT SERIES

Offer full type roller bearing capacity dimensionally interchangeable with ball and cylinder roller bearings of single and double row dimensions. The inner ring may be eliminated for further reduction of radial space.

SEALED—AND STILL COMPACT



No extra axial space needed for the sealed SG series GUIDEROL bearing. Seals are press-fitted securely in the outer race bore to provide the same width and performance advantages of standard GUIDEROL bearings. Contaminants are locked out, lubricants sealed in for those hard to re-lubricate applications. The SG series solves the problem of too-expensive auxiliary sealing assemblies.

Write for McGill's Bearing Catalog #52-A, for engineering data with dimensional and capacity information on McGill needle type roller bearings. Ask about special precision ball and roller bearings.

McGILL MANUFACTURING CO., INC., Bearing Division
300 N. Lafayette Street, Valparaiso, Indiana

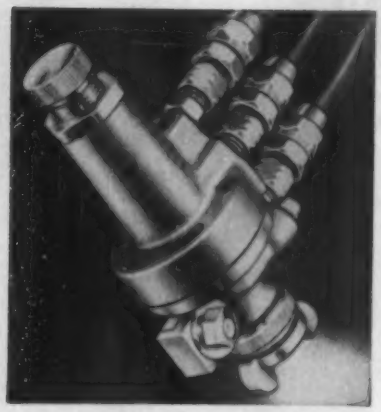
engineered electrical products

McGILL®

precision needle roller bearings

Spray lubrication cuts metal-forming costs

Another benefit of DeVilbiss total service



DeVilbiss WDB automatic spray guns are specially designed for cycled or continuous application of lubricants and coolants during metal-forming and machining operations. Durable WDB guns are adjustable for spray-pattern size, shape, and fluid volume. Fully automatic or manually operated control valves provide up to 60 spray cycles per minute. Contact your nearest DeVilbiss representative or write: The DeVilbiss Company, Toledo 1, Ohio.

FOR TOTAL SERVICE, CALL

DE VILBISS

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23 ADJUSTABLE ROLLER BURNISHING TOOL—*Gustav Wiedeke Co, 1833 Richard St, Dayton 1, Ohio.* Illustrated bulletin RB-17 shows tool sizes, maximum depth of bore, tool dimensions, and construction for tools from 0.375 to 7.437 in. Includes information on preparing parts for roller burnishing. Step-by-step outline tells how to adjust and operate the tool. Feed rates and speeds are listed in tabular form.

HEAT-TREATING AND WELDING

24 NEUTRALENE GAS PRODUCERS—*General Electric Co, Schenectady 5, NY,* 4-page bulletin describes GE's units which provide a lowcost neutral atmosphere to prevent oxidation and de-carburization during annealing, normalizing, hardening, brazing, and sintering. Includes operating data, ratings, dimensions, sketches, and cutaway drawings of gas producer. Application chart shows uses for rich, fairly lean, and lean neutralene gas in heat treating.

25 AUTOMATIC CASEMASTER FURNACE—*Sunbeam Equipment Corp, 180 Mercer St, Meadville, Pa.* 6-page bulletin SEC-9 provides illustrated information on atmosphere controlled furnace for carburizing, carbonitriding, carbon restoration, normalizing, annealing, and hardening up to 1850 F. Sunbeam Endogas generator, a completely automatic unit which produces an endothermic atmosphere to prevent decarburization and scaling during heating, is also described with applications, ratings and dimensions, and performance.

26 PYROMETERS—*Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.* 6-page data sheet ND42-35(1) describes L&N's line of pyrometers for temperature measurements up to 7600 F or 4200 C in plant or lab. Covers construction and operation of the potentiometer-type Optical Pyrometer, graphically showing the application of the disappearing-filament method of temperature measurement. Lists standard pyrometers and their ranges together with accessory equipment to adapt a pyrometer to a variety of specific measurements: a lens for sighting on glowing objects as small as 0.003 in., and emissivity screens for molten metal applications.

"What do you mean 'she blew a gasket'? I haven't gotten mad all day!"

NEW!

IN TRACER MACHINING

TRACE-MATIC

Simple, versatile, full-swing lathe copying attachment. By flip of switch use as standard lathe, for tracing, or thread cutting. Reproduction accuracies to .0005".

RECIPRO-MATIC

The first fully automatic die sink attachment. So automatic that one man can set up and run several machines. Infinitely variable feed rates.

CONTOUR-MATIC

Combines two functions: internal or external contouring with manual or automatic die sinking. Precision to .001".

Any of these exclusive Turchan developments mount on your present machines. They'll put you on the track to low-cost precision tracer machining! Write or phone for full details.

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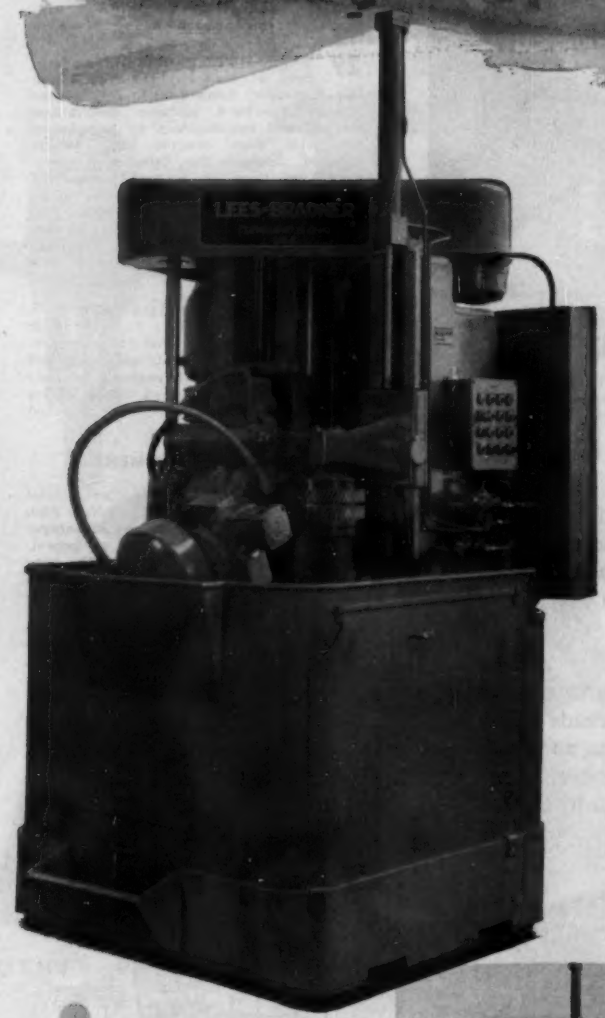
For Machines That Move Mountains...

GEARS

from the NEW 12-HD LEES-BRADNER



You asked for it and Lees-Bradner has built it . . . after years of design planning and months of building and testing.

This rugged hobbing machine — known as the 12-HD 12" x 20" — will produce gears up to 8, 9, 10, even 12 inches in diameter at mass production speeds. A revolutionary innovation is the new variable speed A.C. drive, using stock — *not special* — stock A.C. motors!

Now truck, tractor and earthmoving equipment manufacturers can generate heavy-duty gears as efficiently as smaller ones have been made.

Write Lees-Bradner for all the details — or get in touch with our representative in your area.

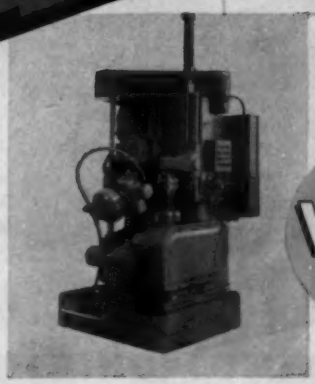
SPECIFICATIONS

Rated capacity in steel	4 D.P.
Max. diameter capacity (with 5" hob)	12"
Max. helix angle	45°
Taper in work spindle nose	16 B & S
Floor space	60" x 60"

THE NEW 12" x 20" 12-HD
Designed to produce large, heavy-duty gears at high-production speeds.
Can be equipped with lead differential, electric hob shifter and hydraulic controls.

See this brand new 12HD and the popular 7HD hobbing machines at The Machine Tool Exposition Sept. 6 thru 16, 1960.

BOOTH NO. 481



IMPROVING GEARS FOR 50 YEARS

the LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

There's a BIG difference in floor absorbents

MAKE THIS DISCOVERY!

RIGHT IN YOUR OWN OFFICE you can test the difference of Eagle-Picher Industrial Floor-Dry with whatever oil absorbent you're now using. You'll discover it actually absorbs as much as 100% or more liquid per pound than other floor drying materials.

YOU'LL ALSO PROVE that Eagle-Picher Floor-Dry retains its skid-proof granular mineral form even when saturated. It doesn't mud or pack. Light in weight, it spreads easier and covers a larger area. Non-combustible, it has no chemical reaction. And possessing unusual reflective power, Floor-Dry makes working conditions bright and pleasant, as well as safe!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. The Eagle-Picher Company, Dept. AM-919, Cincinnati 1, Ohio.

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27 WELDING TRAINING AIDS — *Hobart Welding School, Troy, Ohio.* Fifty helpful welding training aids are listed and described in a folder. Listing includes books on a wide variety of welding subjects; welding charts; educational films; codes; and specifications.

28 RADIANT PLATE ELEMENTS— *Pacific Scientific Co, PO Box 22019, Los Angeles 22, Calif.* 4-page bulletin describes and illustrates Radiant Plate Directed Heat Elements; discusses advantages obtained in use in high temperature furnace design and construction.

29 HEAT DETECTOR CELLS—*Servo Corp of America, 111 New South Rd, Hicksville, Long Island, NY.* 4-page bulletin TB-1300-6 contains descriptions and detailed specifications of Servotherm thermistor heat detector cells. Covers infrared detectors for detecting temperature variations in a broad range of laboratory, industrial, or military operations that are too fast, inaccessible, hot, or rigid in specifications for direct contact with the target. Engineering drawings show cell dimensions and internal cell construction.

30 INFRARED COMPONENTS—*John J Fannon Products Co, 3000 East Woodbridge, Detroit 7, Mich.* Catalog provides data on Infrared—its use, need, and advantages. Enables an engineer to compute 80% of his infrared needs, shows how to order, and to set up an infrared system in the plant.

PLANT SERVICE EQUIPMENT

31 RENTAL SYSTEM — *Clark Rental Corp, 485 Lexington Ave, New York 17, NY.* 16-page booklet outlines advantages of renting materials handling equipment. Through the rental organization, the complete line of fork trucks, powered hand trucks, towing tractors, and straddle carriers manufactured by Clark Equipment Co's Industrial Truck Division can be rented on contracts of from one to five years. One-page chart enables equipment owners to itemize their operating expenses and compare them with the cost of renting comparable equipment.

"Ah! Miss Prout! Come in and bring your book!"

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

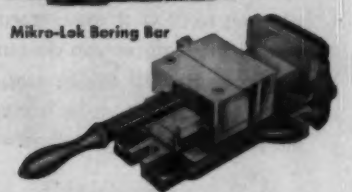
Standard Collet Chuck

Mikro-Lok Boring Bar

Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 1, MICHIGAN

DODGE HAS MORE PROVED BEARINGS THAN YOU HAVE BEARING PROBLEMS!

It pays to buy from a line of stock bearings—bearings that have been proved in thousands of installations similar to yours. You benefit by getting known dependability; and you get the important savings of high quality at production price.

PIN-POINT SELECTIVITY

Dodge has supplied mounted bearings to industry for over three-quarters of a century. Dodge bearings have always kept pace with improved production practices. Each new condition of service has been met by Dodge as it has arisen, with the result that the Dodge line contains mounted bearings to meet almost every service requirement with pinpoint accuracy.

High load, high speed, excessive dust, moisture, corrosion, high or low temperatures, continuous operation—you name it!—such conditions and their combinations are met every day with Dodge bearings.

BROAD LINE—WIDELY DISTRIBUTED

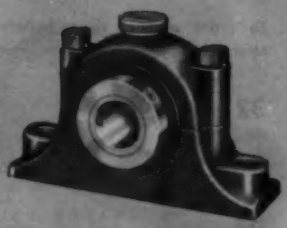
In the great variety of mounted bearings developed by Dodge, you will most likely find the precise unit to fit your requirements ideally—without paying for features you do not need. And if your requirements call for several types of bearings, there is an advantage in having them of common design, such as Dodge offers.

The Dodge line is probably broader than any other line of mounted bearings in America. And of special importance to machinery manufacturers, it is the most widely distributed line. There is always a Dodge bearing of the right type and size near at hand.

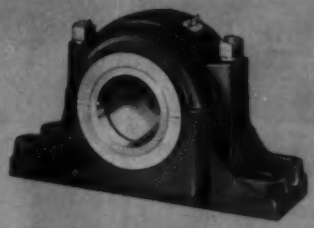
You can check this with your local Dodge Distributor. Ask him—or write us for the Dodge Bearing Bulletin.

In addition to tapered roller, spherical roller and ball bearings, Dodge builds many types of sleeve bearings. Here is the "large and small" of the sleeve type bearings carried in stock—ranging from an 8-in. Sleevoil weighing over 1200 lbs. to a ½-in. solid journal bearing weighing 9 ounces.

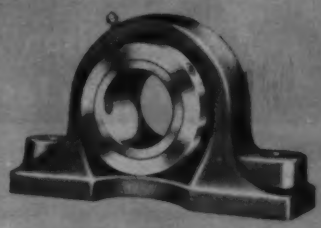
DODGE MANUFACTURING CORPORATION, 100 Union Street, Mishawaka, Indiana



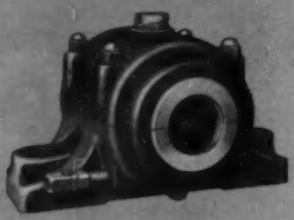
DODGE PILLOW BLOCKS WITH TIMKEN TAPERED ROLLER BEARINGS



DODGE SPHER-ALIGN PILLOW BLOCKS WITH SPHERICAL ROLLER BEARINGS



DODGE BALL BEARING PILLOW BLOCKS



DODGE SLEEVOIL PILLOW BLOCKS

DODGE BRONZOIL PILLOW BLOCKS

DODGE BRONZE BUSHED PILLOW BLOCKS

DODGE JOURNAL BEARINGS SOLID AND SPLIT

DODGE HEAVY RIGID PILLOW BLOCKS

FLANGE BEARINGS; HANGER BEARINGS; BEARING UNITS; TAKE-UPS

● **Dodge Pillow Blocks with Timken Tapered Roller Bearings.** America's quality pillow blocks. Assembled, lubricated, adjusted and sealed at the factory. 5 types for varying needs.

● **Dodge Spher-Align with Spherical Roller Bearings.** Rugged heavy duty, compact, inherently self-aligning. Exclusive Micro-Mount simplifies installation.

● **Dodge Ball Bearing Pillow Blocks.** Deep groove ball bearings with long inner races—high capacity. SL, SC and SCM models for light, normal and medium service respectively.

● **Dodge Sleevoil Pillow Blocks.** Ultra quality . . . extra long life . . . accessibility . . . *quiet*. Plain or water-cooled.

● **Dodge Bronzoil Pillow Blocks.** Efficient, low cost pillow blocks with self-oiling, capillary bronze bushings. Self-aligning. Large oil reservoirs.

● **Dodge Bronze Bushed Pillow Blocks.** Quiet fan and blower pillow blocks with two bronze bushings of high lead content mounted in one cast iron housing.

● **Dodge Journal Bearings — Solid and Split.** True running, dependable. Babbitted bearings with precision machined bores and faces. Finished bases.

● **Dodge Heavy Rigid Pillow Blocks.** Rugged, carefully bored, babbitted pillow blocks for many applications requiring grease lubrication. Finished bases and ends.

● **Bearing Units.** A wide variety—spherical seat, cartridge, flange, hanger, screw conveyor hanger, take-up. Ball, Roller and Sleeve types.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

DODGE

of Mishawaka, Ind.

Easy Operation, Precision Measurements ...with Wilson "Rockwell" Hardness Testers

No matter what your hardness testing requirements are, there's a Wilson Rockwell instrument to do the job easily and accurately. Wilson instruments on the production line and in the laboratory offer these advantages:

Accuracy—Precision-built, with exact calibration, for consistently correct results.

Easy operation—Even an unskilled operator can get perfect readings. All controls conveniently grouped.

Long life—Simple design, rugged construction make Wilson instruments as durable as a machine tool.

Easy maintenance—Interchangeable mechanisms, with spindles mounted in oil-less bearings.

Complete line—Choose from the widest variety of instruments available, including semi and fully automatic models and Wilson "Brale" diamond penetrators.

Write for details—Ask for Catalog RT-58. It gives complete information on the full line of Wilson Rockwell hardness testers and accessories.

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

CIRCLE 310 READER SERVICE CARD

Hillyer *Tape Controlled*
DRILLING MACHINES

SINGLE SPINDLE or TURRET MODELS

- **Lower initial cost**
- **Larger table size**
- **More rigid bridge type construction**
- **Locate zero point anywhere in positioning range**

Important features such as these, plus all the advantages of electrical numerical control (with choice of 1" or 4" tape), are pacing the Hillyer Numerically Controlled Drilling Machines to wide acceptance by industry. Low cost, high quality, high speed performance make the difference, backed by years of successful operation.

It will pay you to find out more about the HILLYER Drilling Machines.

Hillyer

HILLYER CORPORATION
331 CENTENNIAL AVE., CRANFORD, N.J.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

32 PORTABLE SAND BLASTER — *ALC Co, RD 5, Box 40, Medina, Ohio.* Illustrated data sheet gives specifications on new Model B Sandy Jet sand blaster with finger-tip control. Operating air pressure is from 50 to 225 lb.

33 MAINTENANCE PAINTING GUIDE — *Sherwin-Williams Co, Cleveland 1, Ohio.* 24-page guide to maintenance painting of industrial plants, machinery, and equipment discusses different uses for various types of primers and finish coats, and shows samples of colors available. Describes a number of special-purpose paints, detailing their properties and recommended application methods. Proper surface preparation covered; two-page chart pinpoints recommended finishes for different types of surfaces, indicating resistance of each finish to chemicals and other destructive agents.

34 PACKAGED AIR CONDITIONERS —*American-Standard Industrial Division, Detroit 32, Mich.* 12-page bulletin 8825 describes and pictures units and discusses performance characteristics and engineering features of the line. Typical installation photos show units with and without discharge plenum; table is provided to give physical data and to indicate range of capacities available in range of air-cooled and water-cooled units.

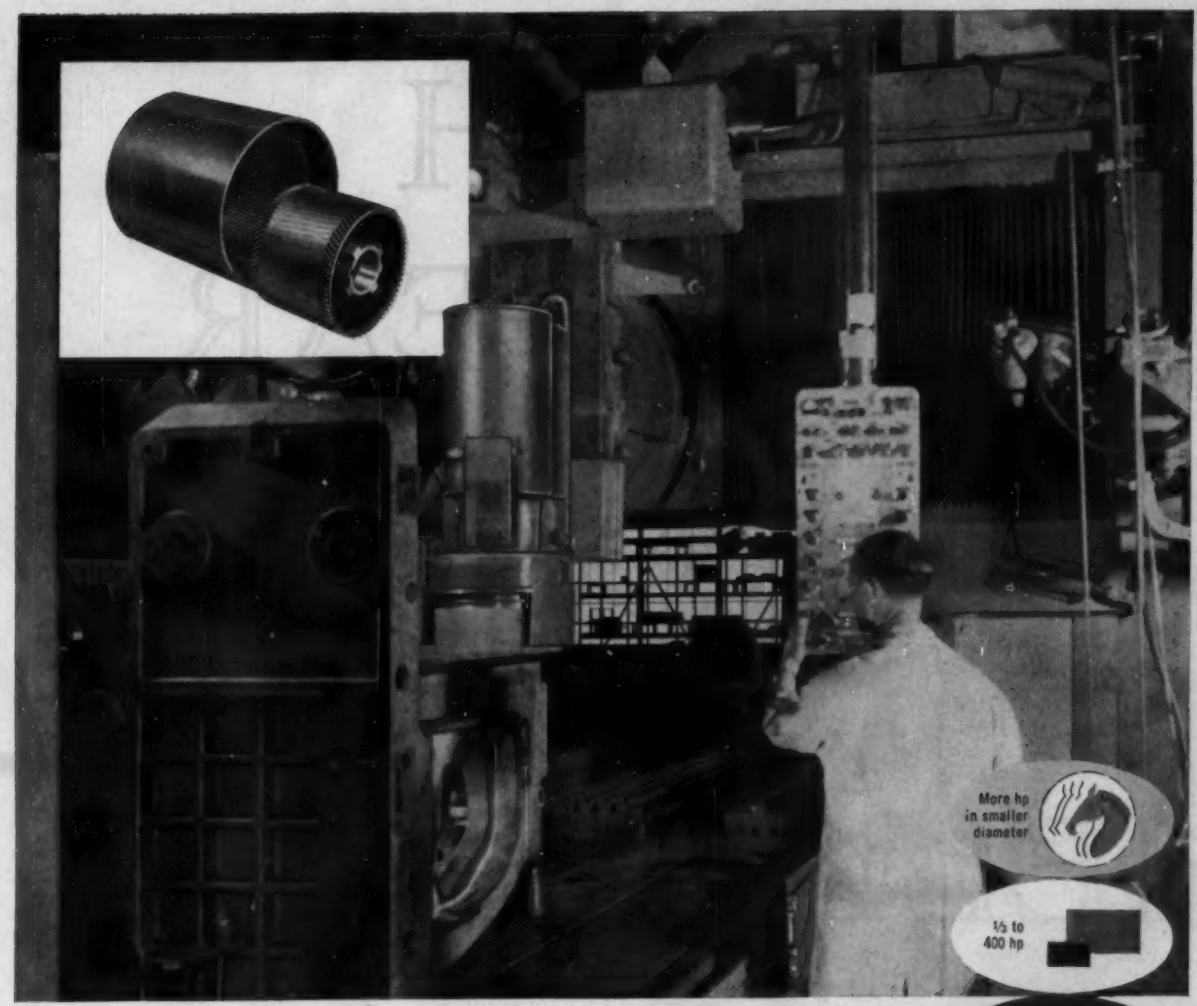
35 SOUND CONTROL—*Allied Witan Co, 12500 Bellaire Rd, Cleveland 35 Ohio,* 12-page catalog illustrates typical sound control applications with graphs showing reduction of noise in decibels, also reduction of noise distinguished by the human ear. Charts indicate flow rates and operating specifications. System can be applied to welding, foundry, presses, tools and assembly.

36 COMBUSTION SAFEGUARDS — *Selas Corp of America, Dresher, Pa.* 12-page bulletin CS-2, Selas Combustion Safeguards, presents an improved line of Automatic Firechecks and a new design of Safety Blowout. Both assembled and exposed views of the compact Firecheck shown, plus advantages of single subassembly of all working parts.

37 HAND SPRAY GUN—*Ionic Electrostatic Corp, 111 Monroe St, Garfield, N.J.* Illustrated bulletin I-60 covers the Ionic Electrostatic unit with electrocentrifugal dispersion. Model 10 utilizes the basic principles of electrostatic spraying, but pre-atomizes the paint particles by powerful turbine-driven centrifugal action, making wrap-around coverage possible for metallic as well as non-metallic paints. Unit is available in a straight or 45° angle head.

(Continued on p 242)

"I want to talk to the welder that repaired my lift truck!!"



This motor can be built-in!

Louis Allis rolled-shell shaftless motors provide compact, close-coupled power for machine tools

Here's just one of many Louis Allis special motor designs that machine tool builders respect and users appreciate. It's a 30 hp, 1200 rpm rolled-shell shaftless motor — pioneered by Louis Allis.

The motor consists of a precision stator in a steel shell and an accurately machined rotor that can be mounted directly on machine tools like the rotary surface grinder shown above.

The compact motor allows closer spacing of spindles and shafts. It reduces the weight and size of the machine — blends the motor into the machine contour. Its design flexibility enables you to use direct drives for separate machine functions — to select motor characteristics best suited for each operation.

Louis Allis rolled-shell shaftless motors range in size from ⅓ to 400 hp. They can be furnished with high torques, low losses for grinder duty, vibration-free operation, and other special modifications. For more information — for engineering assistance — call your Louis Allis District Office. Or write The Louis Allis Co., 452 E. Stewart Street, Milwaukee 1, Wisconsin.

LOUIS ALLIS

SM-107

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

WHICH NEW GEAR PROCESS WILL YOU HELP CREATE

Every new gear production process "we" pioneered in the last 3 or 4 decades—and there have been many—had its origin as a problem faced by one or more people like yourself—men who recognized the existence of a problem and came to Michigan Tool for the answer.

Lets go back to 1925 when automobile transmissions were so noisy that drivers couldn't hear themselves think over 30 miles an hour. Sales complained to management, management to engineering, engineering to manufacturing. They finally came to us and we put our engineers and research laboratory to work. You know the answer—gear shaving and the equipment that made quiet gears practical and economical.

Since those days, "Gear Production Headquarters" has poured out a steady stream of answers to the problems of men like yourself—answers like Shear-Speed gear shaping to make the cutting of toothed parts possible at high speeds; Roto-Flo cold rolling of all kinds of splines, threads and grooves in seconds instead of minutes—stronger and better than if machined; optical sine-line gear checking for either laboratory or on-the-floor control; Gear-O-Mation devices for automatic parts handling in process; double enveloping gearing to carry bigger loads with smaller gears; Ultra-Speed hobbing; hard gear finishing; giant shavers and hobbers to turn out gears up to 20 feet in diameter to almost unbelievable precision toler-

Michigan Tool Company

?

ances to make ship drives quiet to protect against submarines; grinding equipment to make even "spherical" gears.

To make some of the new processes work even better we created new tools, new coolants; new plastics for gear hones, indexing tables which divide a circle into 5 million parts accurate to a fraction of a second; even text and reference books to make gear designing easier.

You too must have a problem . . . large or small . . . about processes, machines or even tooling. Perhaps our experience has already provided the answer. If we don't have it, we'll go to work on it. Chances are we'll come up with it as we have so often before. It's worth trying and *your* Company will benefit.

7171 E. McNICHOLS ROAD • DETROIT • TW 1-3111

Plants in: Detroit, Traverse City and Manistee, Mich. and Windsor, Ontario.

Gear Production: The most complete line of equipment for gear production offered by any manufacturer.

Hobbers and Shapers for Job Lots
High Production Hobbers
Shear-Speed Gear Shapers
Roto-Flo Cold Forming
Shavers for gears of ½" to 200"
Internal and External Form Grinders
Sine-Line Gear and Tool Checkers
Gear Chamfering Equipment
Abrasive Gear Finishers
Mitco Quality Gear Cutting Tools

Automation Equipment (Gear-O-Matic Division): Engineering and manufacture of simple and practical equipment for automating a plant, a line, or a machine. Pre-engineered units for orienting, storage, loading, unloading, assembling, conveying, escapements, positioning, elevating, feeding.

Form Grinding (Gear Grinding Machines Division): "Detroit" fully automatic form grinders for both external and internal contours—involute, cycloidal, spherical, straight sided.

Prototype Gearing (Enterprise Division): Spur, helical, bevel gears and splines for prototypes and in developmental quantities. Also contour form grinding, internal and external.

OTHER MICHIGAN TOOL DIVISIONS INCLUDE:

Cone-Drive Gears Division (double-enveloping worm gears, speed reducers, gear motors); Michigan-Lorenz Division (hobbers and shapers); Shear-Speed Chemical Products Division (coolants and cutting oils); Colonial Tool Co. of Canada Ltd. (cutting tools of all types).

ELDORADO GUN DRILL

DRILL HOLES

more economically...more efficiently, with controlled surface finish.

Drill straight, round, accurately finished holes at high speeds...through solids, blow-holes, hard spots and across-holes, in one single operation.

If you are now using gun drills, it will pay to find out how ELDORADO can cut your costs, give you improved hole finish. Chances are there's an ELDORADO Gun Drill in stock for you. Avail yourself of ELDORADO's experience and research facilities to answer your 'hole' problem.

Send for NEW LITERATURE on Gun Drills and Gun Reamers.

ORDER STOCK SIZES FOR IMMEDIATE SHIPMENT. TO SPECIFICATIONS, ON NORMAL DELIVERY.

MADE TO YOUR SPECIFICATIONS:		AVAILABLE FROM STOCK:	
Sizes	.1250" to 2" dia.	⅛" to ½" dia. in 64ths	½" to ¼" dia. in 32nds
OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit your need	.750" dia. x 2¾" long	1" dia. x 2¾" long
Tips	Carbide	Carbide	Carbide
Now, order from stock, or send in your specifications for a prompt quotation.			

Specializing 100% in Gun Drills and Related Tools.

ELDORADO TOOL & mfg. corp.

Trade Mark

340 Boston Post Road • Milford, Conn.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

PARTS AND MATERIALS

38 SPEED REDUCERS—*US Electrical Motors Inc, PO Box 2058 Terminal Annex, Los Angles 54, Calif.* 12-page brochure contains technical information on shaftmounted geared speed reducers as well as illustrations, feature descriptions, and selection and ordering instructions on the US Shaftmounted Synerogear. Tables show service classifications to be applied in determining the types of speed reducers to be used in different industrial applications and under various conditions of usage. From these tables, in conjunction with horsepower rating tables for frame size selection, it is possible to obtain specific output rpm's in various ranges from 10 to 125 for horsepowers from ¼ to 40. Frame size selection tables are provided for each of three service classifications.

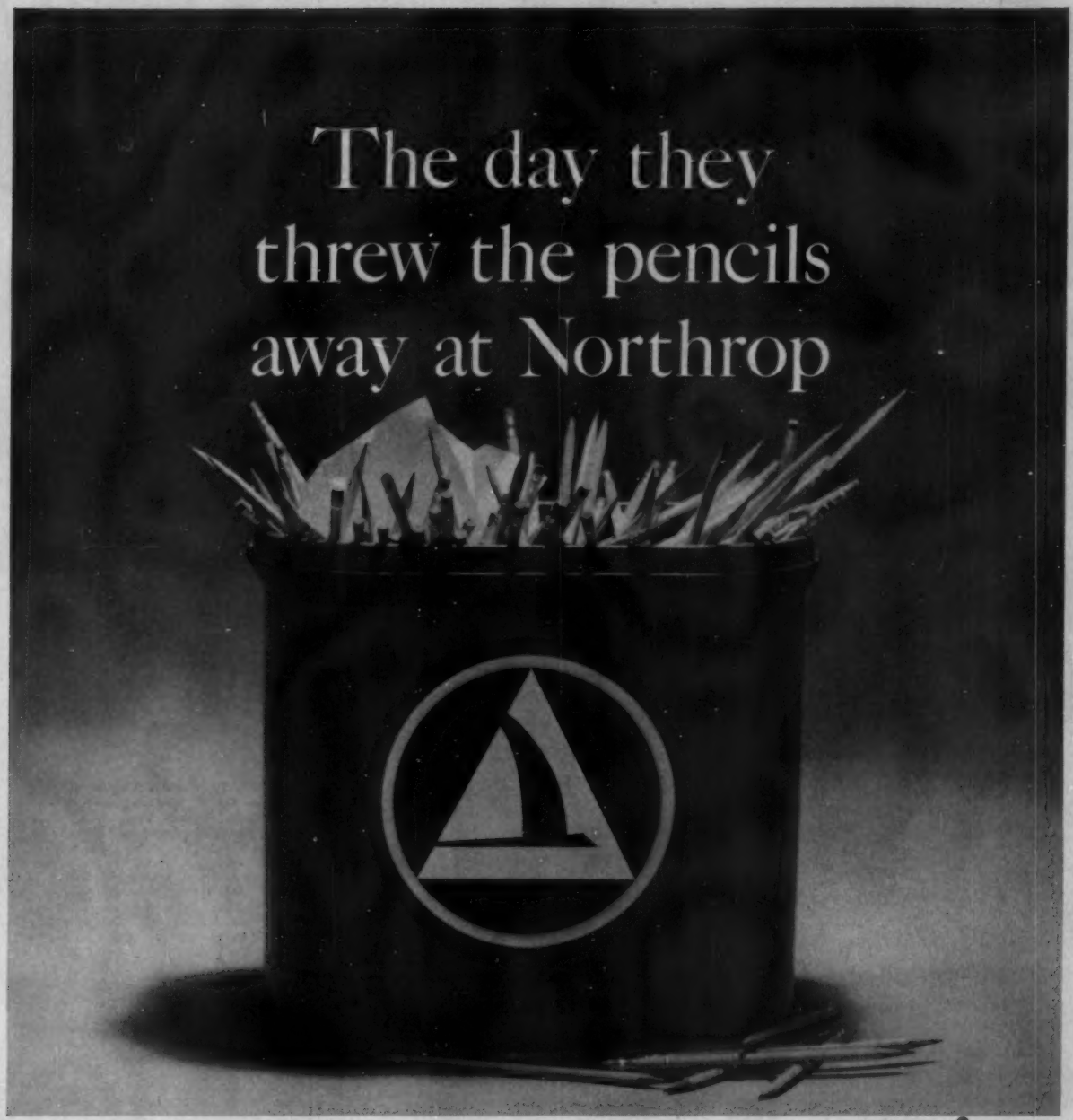
39 CONTROL RELAY—*Westinghouse Electric Corp, Standard Control Division, Beaver, Pa.* 8-page bulletin B-7345 presents illustrated description of the compact BF relay specifically designed for automated machine tools. It is available in both 4-pole and 8-pole frame and has rated full load current of 6 amp at 300 v ac. Advantages cited include up to 50% space saving; front accessible terminals; can be butted without additional electrical clearances; quick coil change when necessary; low temperature operation; extremely fast operating time (pickup: 12.5 to 18.0 milliseconds); low installed cost.

40 PRECISION GLASS COMPONENTS AND TEST INSTRUMENTS—*Fredericks Co, Bethayers, Pa.* 12-page brochure FC 5M 8-60 provides general and detailed information on infrared components such as sapphire-to-glass seals; precision-bore brass tubing vacuum thermocouples; electrochemical glass products; vertical reference levels. The Vacuum Measuring Instruments Division and its facilities is described, and the booklet is excellently illustrated with many examples of products and applications.

41 PHOSPHOR BRONZE — *Riverside-Alloy Metal Division, H K Porter Co, Riverside, NJ.* 18-page technical handbook, up-dated and reprinted from the original published in 1939, includes, in addition to a detailed explanation of continuous casting, information on phosphor bronze wire, bars, rods, strip, sheets, circles, and special shapes. Flexograin, a special fine-grain phosphor bronze, is discussed in detail. Complete specifications on six of the phosphor bronze alloys are included.

*"You're straightening nails . . ? *"&** That happens to be our best surface plate.!!"*

The day they threw the pencils away at Northrop



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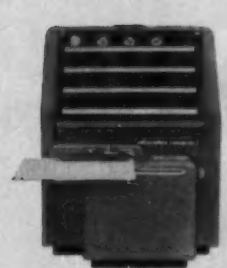


Northrop's Norair Division had a common and very costly bottleneck: internal paperwork.

The solution? *Automated data preparation* by means of a Friden Collectadata® System. Located in key plant locations, Collectadata transmitters report virtually all internal transactions—about 45,000 daily—to central Collectadata receivers which record them into punched paper tape. At day's end, the tapes are then fed into Norair's computer for high speed electronic processing.

Northrop estimates this *completely automated* system will eliminate *two boxcars of paperwork annually*. How much could Collectadata save you? Call your Friden Systems Man or write: Friden, Inc., San Leandro, California.

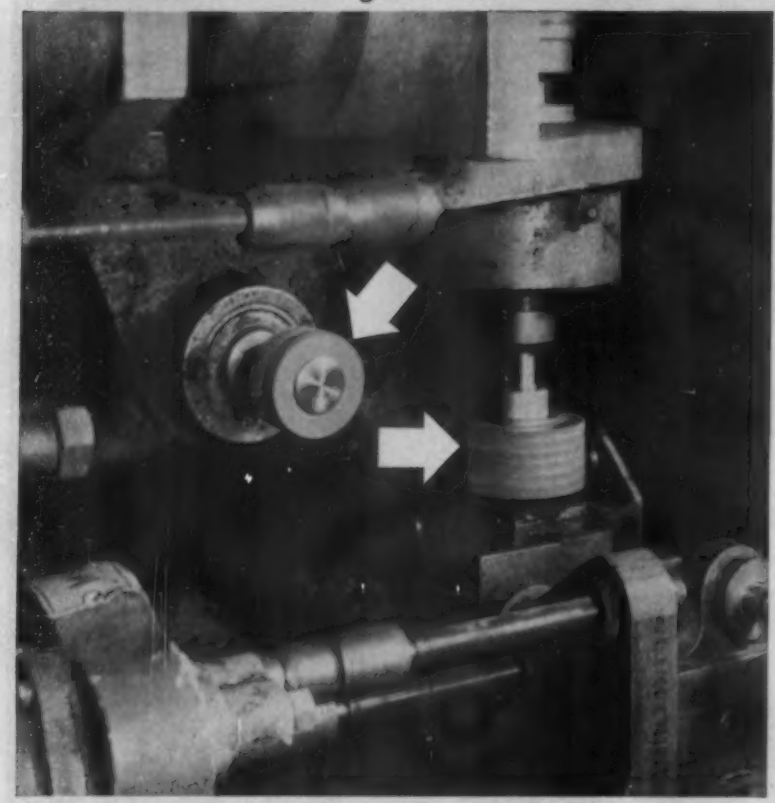
THIS IS PRACTIMATION: Friden specializes in the practical application of automation principles to source data preparation and processing.

Friden Creates A New World for Business®

Friden

SALES, SERVICE AND INSTRUCTION THROUGHOUT THE U.S. AND THE WORLD

FLASH . . . *it's gone . . .*



TWELVE OSBORN TY® RINGLOCK BRUSHES are mounted in two six-stack units on each spindle-head of this specially-built machine. Operating in two planes at 3600 rpm, these Osborn Power Brushes rapidly remove rubber flash from four areas of rubber-bonded-to-steel motor mounts.

FAST *with Osborn power brushing*

Here's how this manufacturer of automotive components licked the problem of troublesome flash removal on rubber-bonded-to-steel motor mounts.

A specially-built automatic machine was equipped with two spindle-heads of Osborn TY® Power Brushes that index and operate in two different planes. The operation quickly, economically removes flash from four areas of each part in just 12 seconds—a vast improvement over slow, costly offhand methods.

Modern Osborn Power Brushing methods can eliminate problems in deburring . . . cleaning . . . polishing . . . precision blending and micro finishing. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no cost—is the first step toward lowering production costs and improving quality. For details, write *The Osborn Manufacturing Company, Dept. C-103, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes
Foundry Production Machinery

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

42 ELECTRIC MOTOR CONTROLS—*Furnas Electric Co, 1044 McKee St, Batavia, Ill.* 56-page pocket-size catalog contains descriptions, ratings, and prices for manual and magnetic starters, drum controllers, pressure, foot, and limit switches. Includes also all pushbuttons and related pilot devices. Motor rating and heater coil data, plus simplified tables simplify control selection.

● ELECTRIC MOTORS—*Doerr Electric Corp, 100 N Fourth Ave, Cedarburg, Wis.* 14-page idea book and condensed catalog contains useful data for designing, selecting, and specifying. Provides construction, dimension, and price data on comprehensive line of fractional and integral horsepower motors; also describes many motor modifications available. Illustrates special designs of varied types. Request direct on company letterhead.

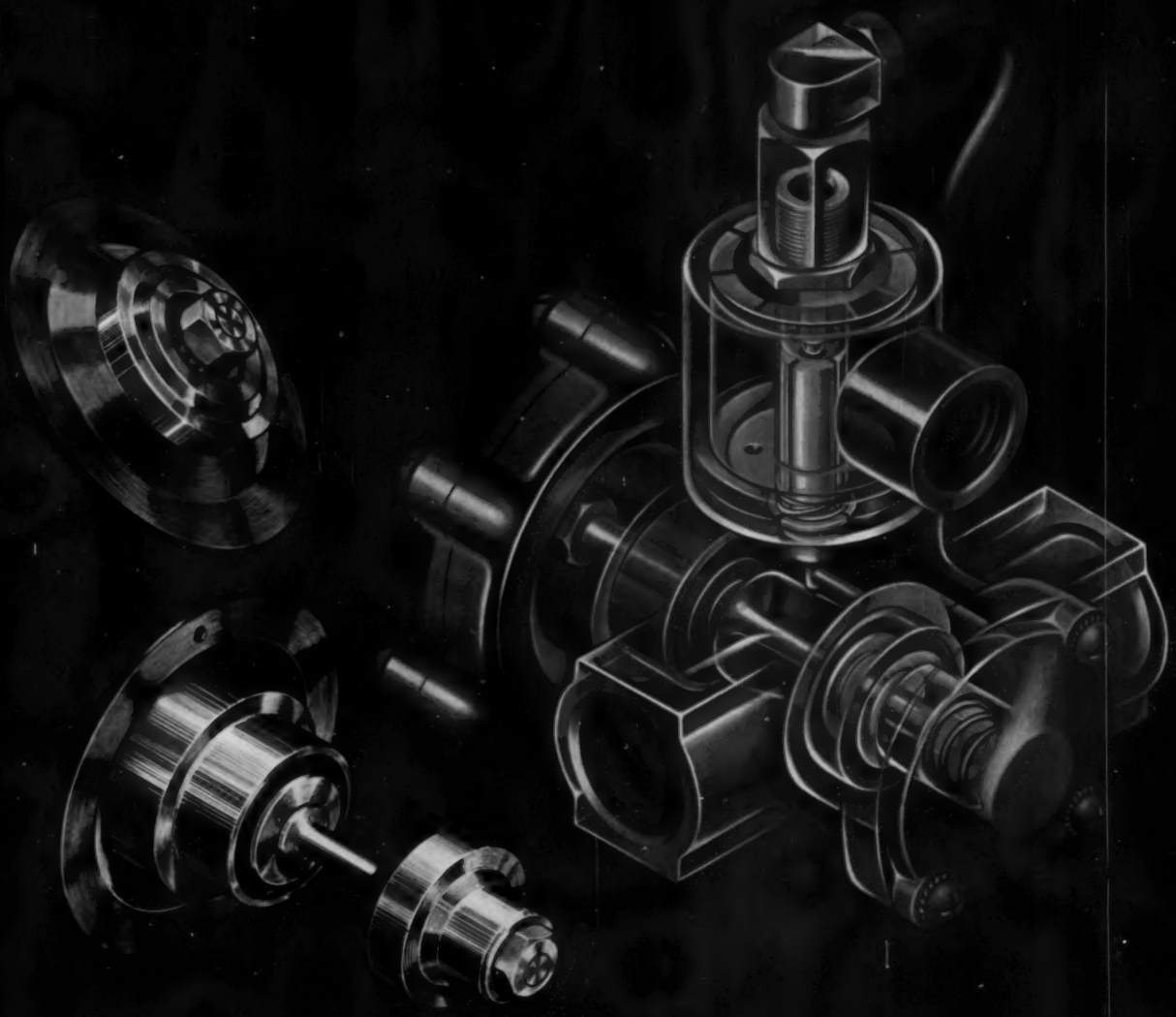
43 PERMANENT MAGNETS—*General Magnetic Corp, 10001 Erwin Ave, Detroit 34, Mich.* Permanent loose-leaf catalog lists stock products. Covers all characteristics of new designs in multiple casts, blocks, bars, cylinders (solid and hollow), salient pole (internal and external radii), curved path and Genox (ceramics) permanent magnets produced by the company.

● PNEUMATIC AND HYDRAULIC EQUIPMENT — *Alkon Products Corp, 299 Central Ave, Hawthorne, NJ.* 24-page catalog covers complete line of cylinders, drill units, and valves. Included is products data and specifications, schematics, prices. Request direct on company letterhead.

44 HYDRAULIC CYLINDERS—*Sheffer Corp, 326 W Wyoming Ave, Cincinnati 15, Ohio.* 16-page catalog 260 illustrates and describes improved C4H Series 2000-3000 psi interchangeable units in bore sizes of 1¼ to 12 in. and 17 mountings. Through use of two foldouts attached to front and back cover, mounting accessory, rod and porting information can be found readily when working with data covering any bore size or mounting style in the series.

45 HOOKER CHEMICALS — *Hooker Chemical Corp, PO Box 344, Niagara Falls, NY.* 16-page digest (bulletin 100-D) gives factual information on 88 commercially produced Hooker chemicals and six development products. Included are more that 20 new or recently developed chemicals. Descriptions, physical data, chemical formula, uses, and types and weights of shipping containers are included.

"He calls it a lathe. But I'll tell you right now it'll never replace whittlin' I"



SKINNER *2-way and 3-way Solenoid Valves*

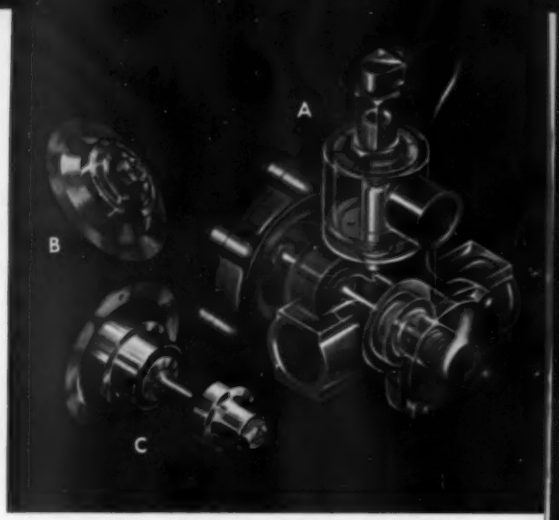
for high flow, heavy-duty industrial use

Skinner combines unique diaphragm assembly and V5 solenoid operator in new L Series valves

Skinner has now combined its famous V5 solenoid operator with a unique diaphragm assembly in a new line of two-way and three-way valves—the versatile L Series.

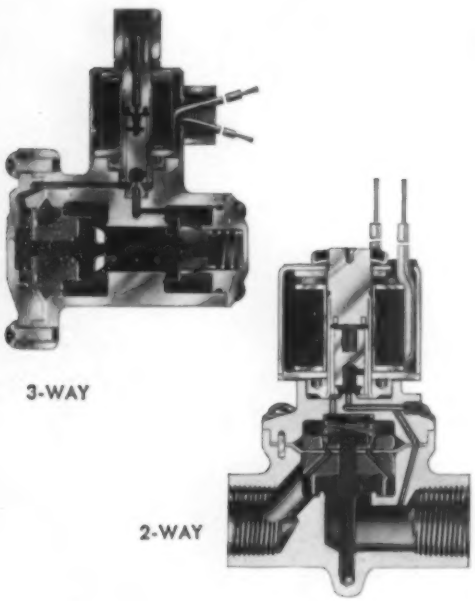
Unusually long life is assured by this new diaphragm assembly. The 3-way diaphragm consists of two tough laminates of nylon fabric coated with a Buna-N rubber separated by a thin Teflon disk. The assembly is virtually 100% supported in the open and closed positions with only a very small area exposed to pressure differential during operation. Life tests show that this type of diaphragm far out-performs all others tested.

The two-way diaphragm and spindle assembly supports a seal retainer and soft, synthetic seal which provides bubbletight sealing of the main orifice. This seal fits on a shoulder which extends beyond the seat and helps to cushion the closing motion—thus minimizing water-hammer.



A—Transparent view of normally closed 3-way solenoid valve
B—Front view of diaphragm assembly
C—Spindle seal retainer and diaphragm assembly

Low cost 2-way and 3-way valves to meet your high flow industrial requirements



Cutaway views of 2-way and 3-way valves showing how the unique diaphragm assembly and solenoid operator are combined in these new valves.

Skinner L Series solenoid valves feature forged naval brass bodies, stainless steel and brass internal parts. They are available normally closed, normally open and directional control in standard and explosion-proof construction.

In addition to the many exclusive features, these Skinner valves are low in price, and with one model—a 2-way normally closed valve—available at especially low budget cost.

All 3-way and 2-way normally open valves are supplied with a piped exhaust return. For catalogs and complete information, contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

SKINNER L SERIES SPECIFICATIONS

	TWO-WAY	THREE-WAY
Pipe Sizes, NPTF	⅛"*, ½", ¾", 1"	⅛", ½", ¾"
Orifice Sizes	½", ¾", 1"	⅛", ½", ¾"
Operating Pressure Differential — Minimum	5 PSI	5 PSI (⅛" 10 PSI)
Operating Pressure Differential — Maximum	150 PSI	150 PSI
Position	Normally closed, Normally open	Normally closed, Normally open, Directional control
Leakage	Bubbletight	Bubbletight
Temperature Range (Ambient and Media)	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F

*has ½" orifice

When you specify solenoid valves, specify Skinner.

Skinner solenoid valves are distributed nationally.

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION,
THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

Clearing Division of US Industries has named **T Singelis** (left) vice president of marketing services. He was formerly vice president of advertising of US Industries. **John W Rayner** has been appointed administrative assistant to the president of Clearing. He has been industrial relations director for two Chicago area firms, Nachman Corp, and Benjamin Electric Co

Norma-Hoffmann Bearings Corp, Stamford, Conn, has elected **Howard A Baxter** vice president, engineering. He succeeds **Warren D Anderson** who will continue as engineering consultant to the president. Mr Baxter was previously director of technical services at American Machine & Foundry Co's Greenwich Engineering Division

NAMES IN THE NEWS...

US Industries Inc has appointed **Michael L Mandeville** president of the International Division. Formerly executive vice president of the division, he succeeds **R S Wright** who was recently named vice president, international trade, of the parent company.

E W Bliss Co, Canton, has appointed **Belmont Pinney** to the new position of assistant manager of the Hastings, Mich, Division. He was formerly production manager of the equipment manufacturing division of Continental Can Co.

Saco-Lowell Shops, Boston, has appointed **Erik O Pierson** works manager of the Automotive Division at Saco, Maine. He was formerly vice president and works manager of Whitin Machine Works.

Casting Engineers, Chicago producer of investment castings, has appointed **John McCormick** plant manager of the firm's newly acquired Jelrus Precision Casting Co plant in New York. Mr McCormick previously served as chief engineer for Casting Engineers.

Union Carbide Corp has elected **Birny Mason Jr** president. Formerly executive vice president, he succeeds **Howard S Bunn** who has been elected to the newly created office of vice chairman of the board.

Sperry Products Co, Danbury Conn, division of Howe Sound Co, has named **Philip J Parker** general sales manager. Mr Parker was formerly executive vice president of Peterson Machine Tool Inc, Merriam, Kans, acquired recently by Sperry.

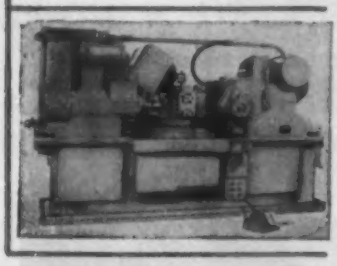
Carborundum Co, Niagara Falls, has appointed **M S Day** manager of the Research and Development Division's Stupalox ceramic cutting tool project at Latrobe, Pa. He was formerly in charge of sales for the new products branch of the division.

Oakite Products Inc, New York manufacturer of specialized chemical compounds, has elected **William A Baltzell** vice president. He will continue to serve as industrial sales manager. **J Justin Basch,** elected second vice president, will continue to be responsible for the firm's marketing and research and product development programs. **John B Holland** has been appointed Automotive Division manager. Prior to joining the company he was associated with Ford Motor Co as production engineer.

E W Bliss Co, Canton, Ohio, has elected **J Ralph Patterson** (left) president and chief executive officer. Formerly vice president in charge of the company's Mackintosh-Hemphill Division, he succeeds **Robert Potter** (center) who has been elected chairman of the board. **Richard E Rassel** (right) has been appointed to the newly created post of manager of automotive press sales. He has been a sales engineer handling automotive accounts in the Detroit area for the past 17 years

Single set-up covering
ALL finishing operations...

MEANS GREATER ACCURACY
with
GOSS DeLEEUW



AUTOMATIC CHUCKING MACHINES

One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & DeLeeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & DeLeeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NAMES IN THE NEWS...

Howe Sound Co, New York, has named **Albert H Charlton** vice president. He will head up the company's Rolling Mill Division. Mr Charlton has been president of Quaker State Metals Co, Lancaster, Pa. This company is now a division of Howe Sound and one of the largest independent producers of aluminum sheet and coil in the country.

Dana Corp, Toledo, has named **William E Vogel** chief engineer, manufacturing research and development. Mr Vogel has been serving with Dana's subsidiary, Atlas Drop Forge Co, Lansing, Mich.

Fairbanks-Whitney Corp has announced that **Thomas G Lanphier,** formerly associated with **Convair-San Diego,** is joining the organization as vice president, planning. Mr Lanphier will be responsible to the president for development and integration for project planning for several of the corporation's subsidiaries including Fairbanks-Morse in Chicago, Pratt & Whitney Co, and Chandler-Evans Corp in Hartford, Conn.

United Welders Inc, Bay City, Mich, has named **W Blake Tripp** plant manager. He will be responsible for engineering and manufacturing the special-purpose welding and assembly machines made by the company. Mr Tripp comes to United after nine years with Avco where he was chief industrial engineer for special projects.

Minneapolis - Honeywell Regulator Co has appointed new general managers for two of its Industrial Products Group divisions. **Kenneth Brierley** will be responsible for expanding activities of the Fall River, Mass, Division, producer of electronic process instrumentation. **John K Hagen** succeeds Mr Brierley as head of the Rubicon Division which manufactures test and calibration instruments.

Wedgelock Corp, North Hollywood, Calif, manufacturer of aircraft fasteners and assembly tools, has elected **Lewis C Finkle** executive vice president. **William Grant,** general manager, has been named a vice president, and **James H Lee** has joined the organization as sales manager of the Fastener Division.

(continued on p231)

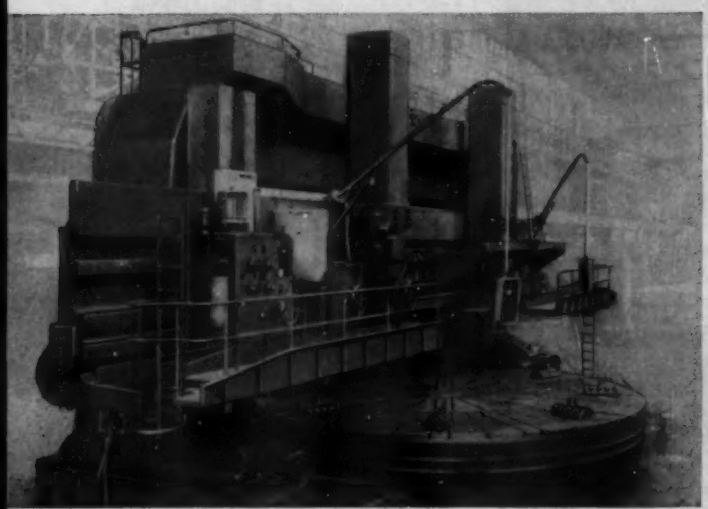
watch these giant workers chip away costs!

This 8⅛ in. SCHIESS model BF horizontal boring and milling machine...
now completely redesigned with many innovations. Here are a few...

Two individual drives—gear-drive for roughing, belt-drive for finishing. Belt-drive particularly suited to high-speed machining with carbide tools. New tool clamping device—does away with draw keys, hammers, drifts and binding screws. All spindle-slide movements controlled from easily accessible operating platform (or from pendant station or portable control panel, if desired). Special main-drive belt requires no readjusting. Column, spindle-slide and boring spindle may be adjusted at rapid traverse.

Spindle diameters, 6-5/16″ to 8-7/8″. Maximum diameter bored, 59″—faced, 79″.

It takes Europe's largest builder of heavy machine tools, Schiess, to turn out giants like these. Parts and service as close as Pittsburgh. And an American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all Schiess BF and K models.



This 32 ft. SCHIESS model GK vertical boring and turning mill...
Look at all these new features of the most modern vertical boring mill of its type: Two ram heads on the rail, one of which is tracer-controlled. One milling head on the rail which can be parked on the left side rail extension. Dual tables—one 15′ table on the inside, a 32′ table on the outside. Each table has independent drive, or both tables can be used together and synchronized as one. Table equipped with indexing device to be used for indexing layout work. Machine will swing a maximum diameter of 40′. Rapid traverse motions with pushbutton control of changeover from feed motion to independent power traverse. Electro-mechanical locking of cross-rail to columns. Fingertip speed control—counter-balanced cross-rail and side-head—completely enclosed swiveling octagon rams—pendant control—automatic lubrication.

Have you ever seen anything like it?

SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

CIRCLE 322 READER SERVICE CARD

Another SPEED NUT Savings Story...

62% cost reduction made with **SPEED CLIPS®** on Cramer Posture Chairs

A dozen SPEED CLIPS now do the job of fastening upholstery to the steel seat of Cramer Posture Chairs. Before the switch to Tinnerman SPEED CLIPS, an expensive formed-steel rim was spot-welded to the seat to do this job.

SPEED CLIPS save Cramer at least 46 cents—or 62% of fastening cost—on each chair ... they eliminate the rim-forming and spot-welding operations... permit faster, easier assembly... simplify disassembly if the chair ever needs re-upholstering. Working jointly with Cramer's engineering staff, Tinnerman fastening specialists were able to provide all these advantages without sacrificing product quality.

Assembly costs on your product are likely to benefit greatly, too, if you'll enlist the aid of this Tinnerman team. You can arrange for a free FASTENING ANALYSIS of your product simply by calling in your nearby Tinnerman representative. You'll find him listed in the "Yellow Pages" and in Sweet's PD File under "Fasteners." Or write direct to:

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Dept. 12 • P. O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
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FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Muzzo-Dandy GmbH, Heidelberg.

NAMES IN THE NEWS...

Split Ballbearing, Lebanon, NH, has appointed **Elmer W Richardson** general sales manager. Mr Richardson was formerly director of marketing for Olin Mathieson Chemical Co, Aluminum Division, and general sales manager of H K Porter Co's Refractories Division.

Havir Manufacturing Co, Minneapolis, has appointed **Thomas H Havir** sales manager to handle national distribution of all Havir Hi Speed automatic presses, Press-Rite power presses, and Shape-Rite Shapers. Prior to his new appointment Mr Havir was sales manager of the Press-Rite Press Division, Sales Service Machine Tool Co, St Paul.

Butterfield Division of **Union Twist Drill Co,** Derby Line, Vt, has appointed **Laurence D Gillane** sales supervisor for metropolitan New York, the states of New Jersey and Delaware, and eastern Pennsylvania. **Howard J Baetz** has been named district manager of the Great Lakes area with headquarters in Detroit. Mr Baetz will be responsible for the complete Butterfield sales program in the area which is made up of the states of Michigan, Ohio, and western Pennsylvania.

Morse Twist Drill & Machine Co, New Bedford, Mass, has named **Max E Miles** service engineer in the southwest sales district. He will make his headquarters in Dallas.

Schaevitz Engineering, Pennsauken, NJ, has elected **Paul Cherkas** president of **Measurement Control Devices,** a wholly owned subsidiary. Prior to joining Schaevitz Mr Cherkas was manager of research and development for the Gage Division of Pratt & Whitney Co.

General Mills, Minneapolis, has named **Kenneth J Carlson** vice president and general manager of the **Daven Co,** Livingston, NJ, subsidiary which produces electronic components and instruments. Mr Carlson was previously director of planning and development for the Mechanical Division of General Mills.

Gardner Machine Co, Beloit, Wis, has announced the retirement of **Harold Prigoff,** district sales manager in charge of eastern sales, who has been associated with the firm for 37 years.

A NEW "COMPACT" HITS THE MACHINE TOOL FIELD...

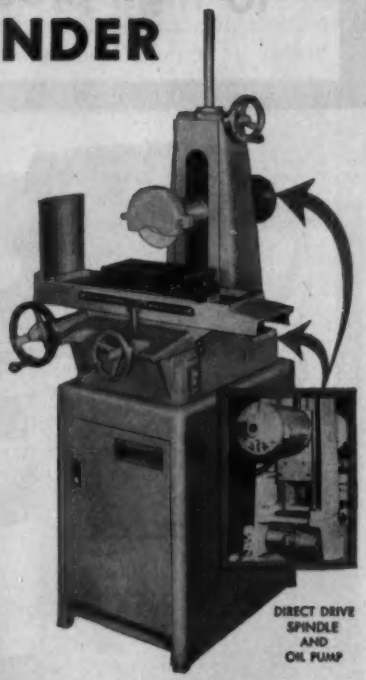
THE NEW HARIG 612 SURFACE GRINDER

with

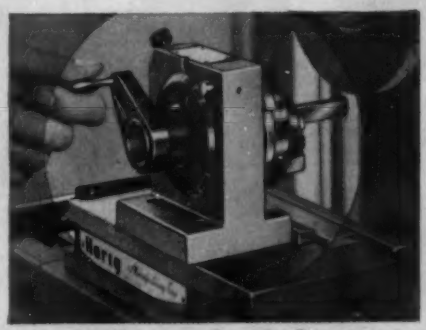
* **Automatic forced lubrication** goes into operation as soon as machine is started — triples life of the ways and preserves original accuracy.
* **Direct drive spindle** increases power . . . reduces vibration . . . no V-belts to replace.
* **Your choice of right or left hand longitudinal feed**

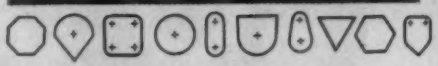
All Standard Equipment

The new 612 represents a break-thru in design and construction whereby Harig now offers industry a low-cost, precision surface grinder loaded with features usually found only on expensive models. Easy to operate . . . requires little maintenance . . . built with the precision quality you expect from Harig.



GET ALL THE FACTS...
Write for brochure on the Harig 612 Surface Grinder





WRITE FOR THE NEW GRIND-ALL BROCHURE

... AND HARIG'S NEW IMPROVED GRIND-ALL FIXTURE

Easily grinds irregular shaped perforators concentric with shank within ± .0001 accuracy. Also can be used for milling, boring, inspection, and radius dressing. New features include v-block adjusting screw and sine arrangement to obtain any desired angle.

WHATEVER YOUR TOOLING REQUIREMENTS . . . HARIG IS READY TO SERVE YOU!

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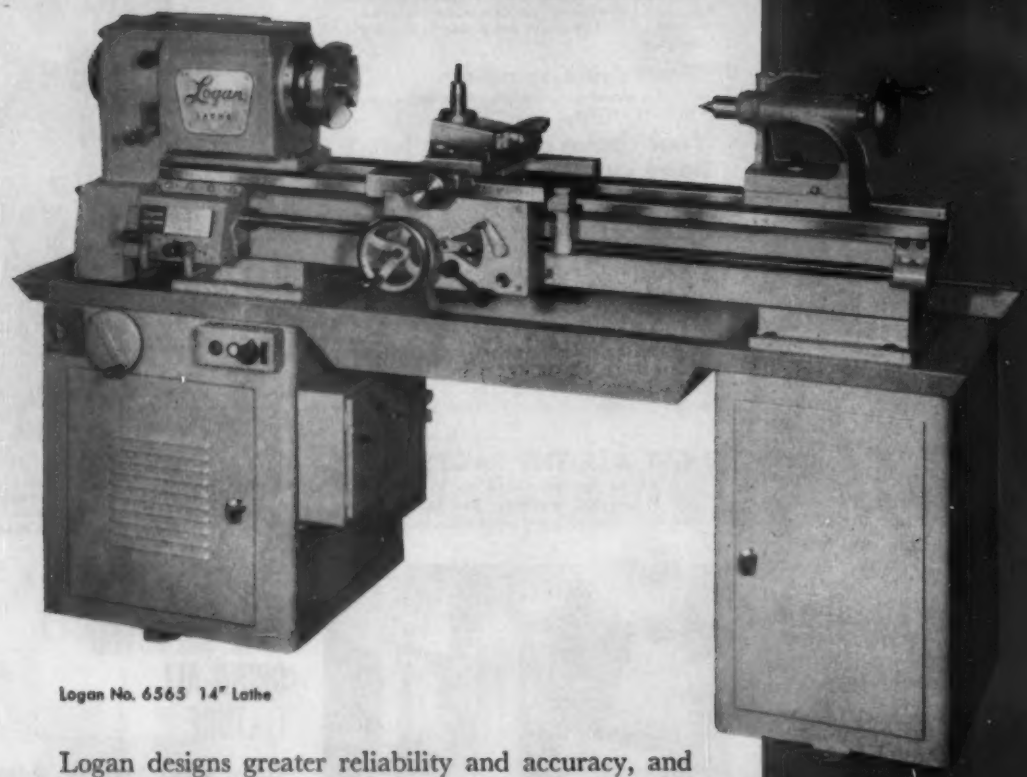
its specifications add up to high production capacity

Logan 14" Lathe



Logan No. 6565 14" Lathe

Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-quality features. For instance—

- An oversize spindle with 1⅝" bore turns on four super-precision ball bearings with built-in preload
- A variable-speed drive lets you change speed while work is turning—without shifting belts
- A warp-free lathe bed with high, strong walls braced by oversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground.

There are many more reasons why this and other Logan Lathes have a greater capacity. The specifications tell the story. Write for literature and complete information.

- Spindle speeds to 2000 rpm.
- 1½" Levermatic collet chuck capacity
- 14⅝" swing over bed
- 9" swing over saddle cross slide
- 40" between centers

LOGAN ENGINEERING CO. Dept. G-960 4901 Lawrence Ave., Chicago 30, Ill.

ALEMITE BARREL-TO-BEARING LUBRICATION

the "moving force" of production!

More and more, cost-conscious plant men are recognizing modern lubrication as an important "production tool." No longer do they see it as a simple maintenance problem.

With the years-ahead Alemite Barrel-to-Bearing Lubrication method, today's leading manufacturers are stepping up production . . . reducing downtime . . . extending machine life.

Included in a complete Alemite barrel-to-bearing lubrication method can be electric, air or hand-operated equipment. It will more than meet every need for high-pressure lubrication, filling hydraulic systems, servicing oil reservoirs, lubricating gear housings, and refilling grease guns.

Write for free Alemite catalog today!

Symbol of SW Excellence

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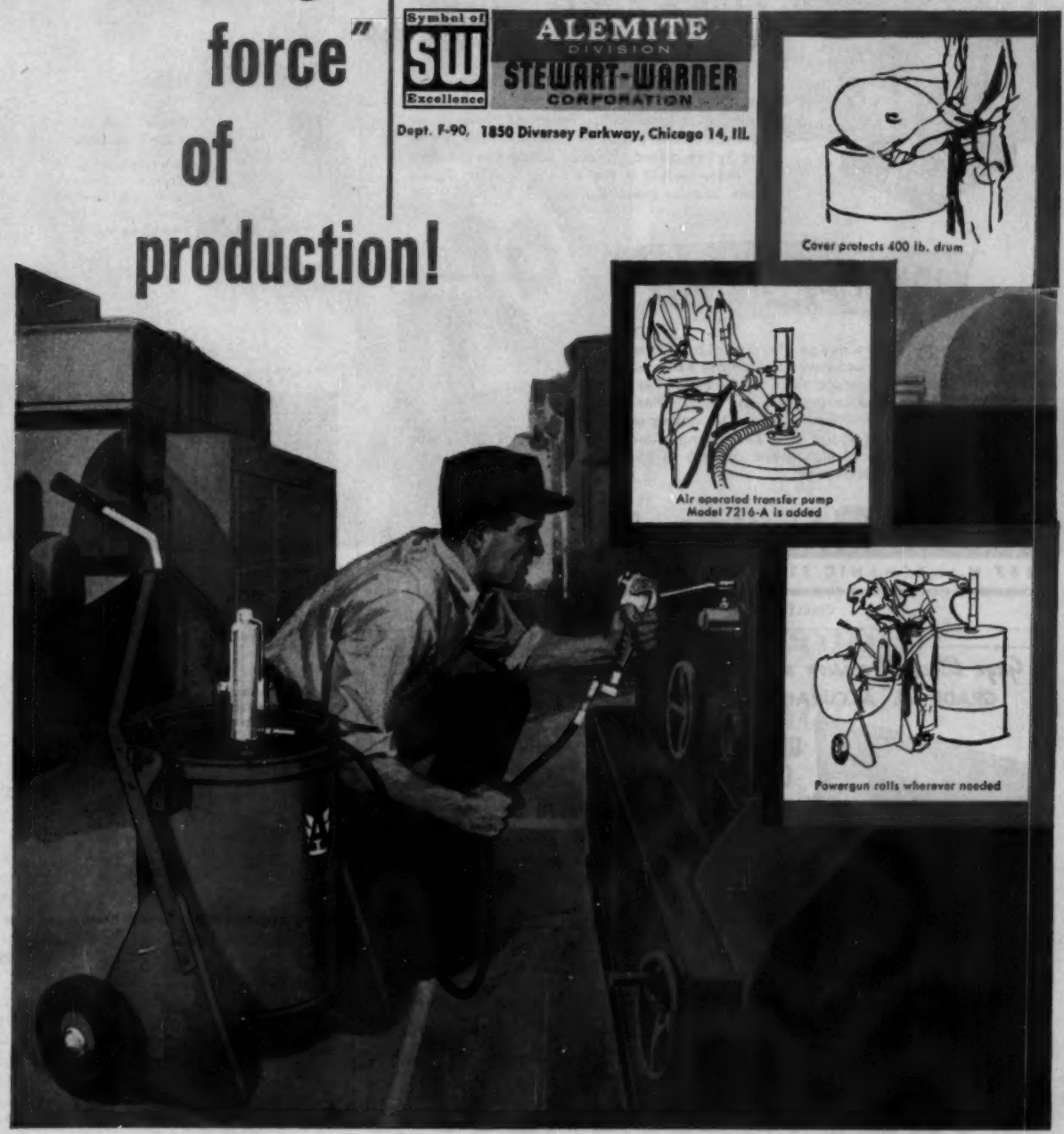
Dept. F-90, 1850 Diversey Parkway, Chicago 14, Ill.



Cover protects 400 lb. drum

Air operated transfer pump Model 7216-A is added

Powergun rolls wherever needed

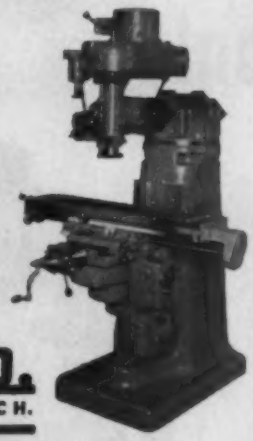
A Lot More
POWER
A Lot More
ACCURACY
ECONOMY too!

INDEX "SUPER 55" VERTICAL MILL

● 1½ HP Head or optional 2 HP with continuous duty motor gives 50% or more capacity . . . More rigidity, more accuracy . . . Increased horse power and dynamically balanced Cast Iron Pulleys and Drive System afford improved production capacity . . . More weight in the column, heavier ribbed column, heavier knee, heavier saddle.

INDEX "45" VERTICAL MILL

● Unique square design of overarm affords more rigidity, greater accuracy . . . Provides extra range and capacity . . . More power at the cutter. No adjustment required on overarm and head after use . . . No need to re-indicate head after moving overarm . . . Speed range with nine changes makes possible the use of high speed or carbide tipped cutters to best advantage.



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Gage Block Precision means
GRADE "A" ACCURACY*
with
ULTRA-CHEX GAGE BLOCKS
82 PIECE SET...
NOW ONLY **$249.50**
*Grade "A" Accuracy: −.000002" and +.000006"

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Detailed techniques on high-energy-rate forming from four major sources: one on general theory, one on aircraft applications, one on tube forming and one on cup forming. . . . Fully illustrated, twelve pages, 30 cents per copy.

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CONSIDERING NEW CUTTING MACHINES?

Yes?-----? Then before you commit yourself you should investigate

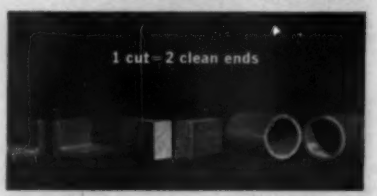
"CUT-MACHINING"

DON'T wait and BE UNHAPPY later!
Hundreds of men are more than happy with their choice of a Wallace "Cut-Machining" Unit.

Phone—Jack Voss. Collect, of course.

His bread and butter depends on how well he matches the right cutting unit to the work you must do.

With a Wallace "Cut-Machining Unit" you will get:



Pipe • Tube • Bars • Angles • Channels • Plate!

No matter what, you get . . .
2 finished ends each time you make 1 cut.
Guaranteed? Sure! Since 1896.
"You must be satisfied or you owe us nothing" has been our customers' assurance.

Phone "Jack" today.
Or if you prefer — write him.

WALLACE
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Phone BUckingham 1-7000 (Collect, as we said before)
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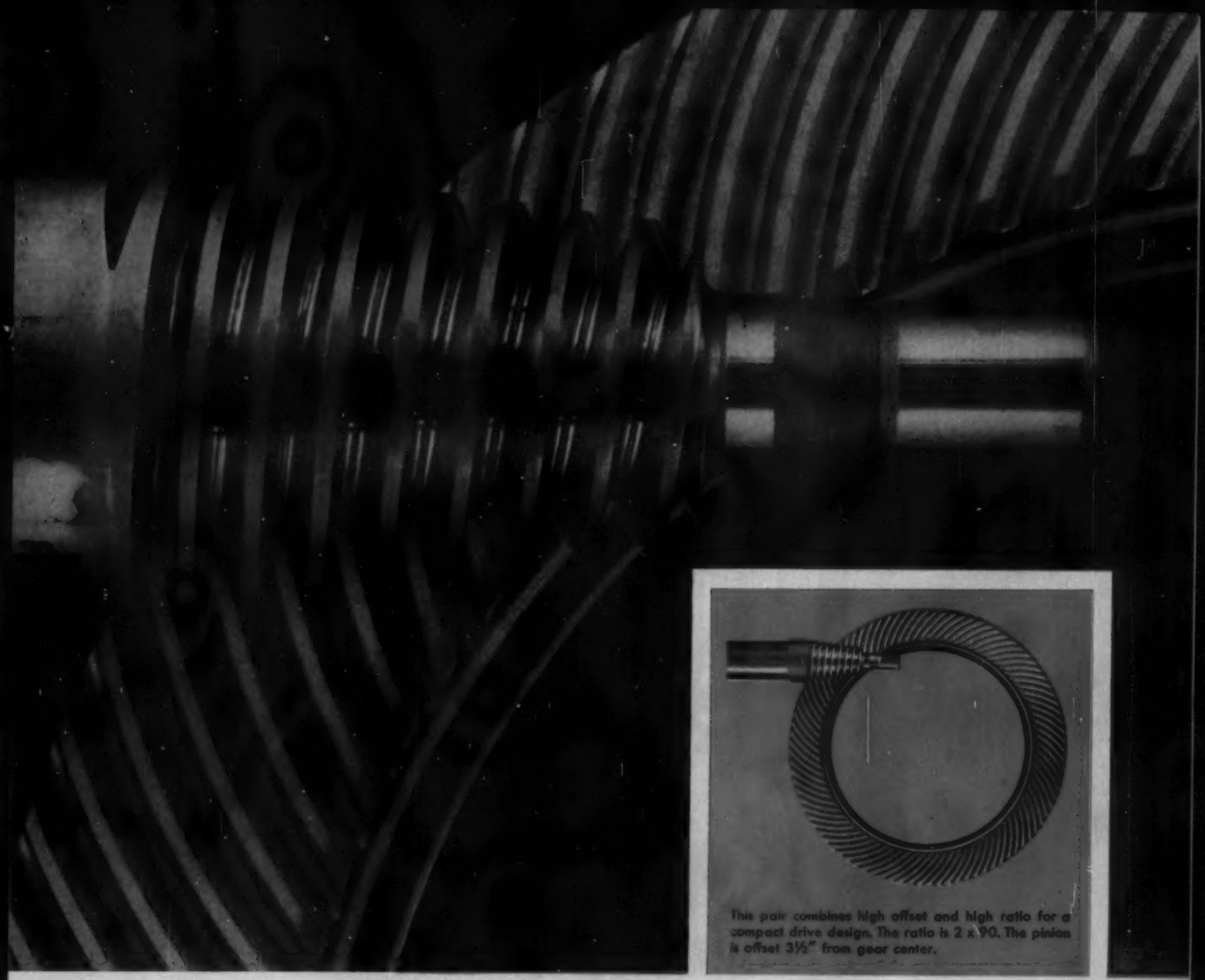
CIRCLE 328 READER SERVICE CARD

CIRCLE 330 READER SERVICE CARD



This pair combines high offset and high ratio for a compact drive design. The ratio is 2 x 90. The pinion is offset 3½" from gear center.

See how the teeth "wrap around" this high-reduction pinion

This is a high-ratio hypoid gear. In principle, it is not different from more conventional hypoids produced by the Gleason Works. *But . . .*

If you look closely at the pinion, you'll notice that the teeth tend to "wrap around" it. This design is extremely well suited for high reduction, strength and compact design.

The result is a conical (or sometimes cylindrical) pinion which permits *continuous tooth action—even with just one or two teeth!* Compared to corresponding bevel pinions, its diameter is greater for higher strength. An extended shank on cylindrical pinions makes *very rigid* straddle mountings practical.

You can design a *compact* unit, because high offset is possible! For high-offset *or* high-ratio pairs, the "wrap around" tooth design provides an extra measure of the smooth, quiet tooth action of hypoid gears.

High-ratio hypoids can be cut on the same Gleason equipment that is used on more familiar spiral bevel gears and hypoids. You can also use the same testers, quenching presses and other auxiliary Gleason equipment you're using now. Grinders are available for applications requiring precision finish.

High-ratio hypoids can be produced by the Gleason Works for ratios of 1:10 or 1:40 or even higher. They are finding a growing number of applications in such diverse fields as farm machinery, instrumentation and office equipment.

You can get more information about Gleason high-ratio hypoid gears by writing for free literature. Submit your prints for recommendations.

GLEASON WORKS

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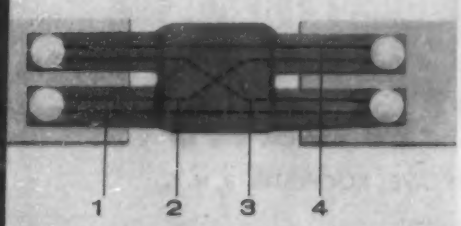
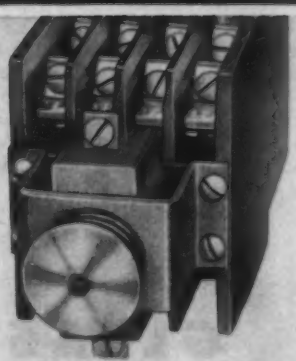
CIRCLE 331 READER SERVICE CARD

Another Cutler-Hammer first! Up to 24 poles in an area less than the size of a dollar bill.

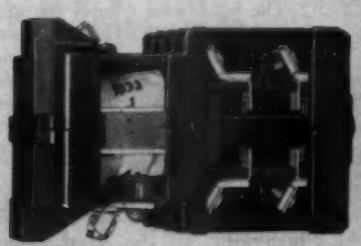
New contact reliability. Parallel bifurcated contacts, which allow four current paths instead of one, provide infinitely greater circuit reliability . . . liberally designed so any current path carries full relay rating.





At last! "Mechanical memory" latch as reliable as the relay itself! No adjustment ever needed. Add latch at any time.

New simplified design! Cutaway view shows basic simplicity. Coil vacuum impregnated to resist damage from humidity, vibration, electrical stress. Terminals can be screw or spade type.



Space savingest relay you've ever seen: New Cutler-Hammer "Compact 300"

Versatile 300 V. control relay is so reliable it's permanently sealed!

Here is the best answer yet to the need for an extremely reliable, small-size 300 V, 6 amp., industrial relay—the new "Compact 300" from Cutler-Hammer.

Every detail known that affects relay reliability has been improved in the "Compact 300." Bifurcated contacts which make possible *four* current paths rather than one, add millions of operations to the "Compact 300's" electrical reliability.

In fact, we're so confident of its electromechanical reliability, we permanently enclose the "Compact 300." And, if it should be damaged by a fault current, you throw it away and replace it with a new one. Its low price makes this an economical, practical maintenance procedure.

Now think of the space you can save with the "Compact 300." It controls up to eight circuits in panel space only 2" wide by 2¾" high. 2, 3, 4, 6 and 8 poles with any combination of N.O. or N.C. contacts are available, of course.

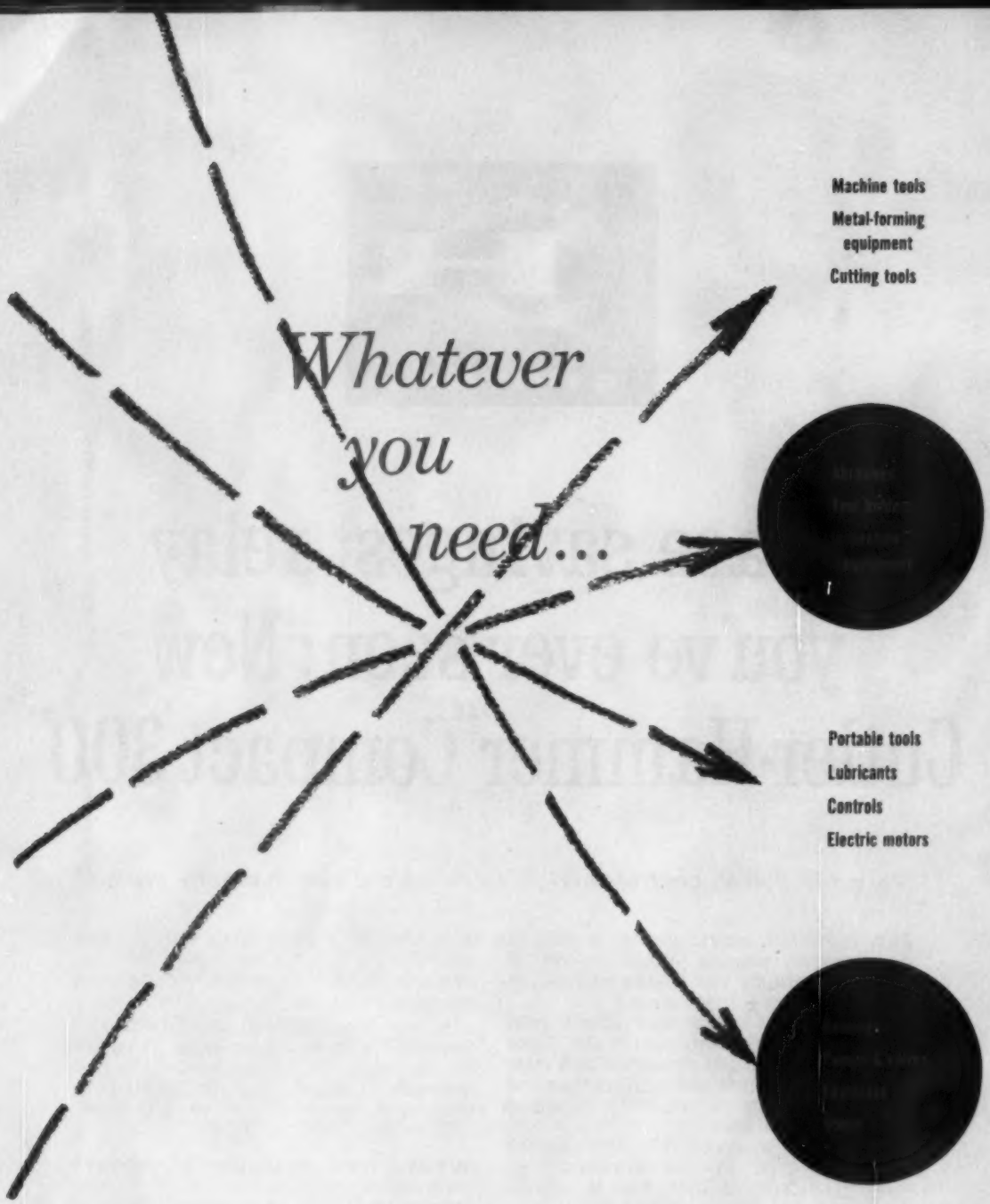
At any time, you can add "mechanical memory" latch with a life equal to the life of the relay. No adjustments are ever necessary. Contact your Cutler-Hammer distributor for details on the "Compact 300" or send for Pub. ED-L079-S239.

What's new at Cutler-Hammer? New, better products, like the 300 V. relay are coming steadily from our new, expanded plant facilities. We're ready now to help you take care of the great industrial growth of the future. If you are planning ahead and need electrical control assistance, contact the nearest Cutler-Hammer sales office.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.



Whatever you need...

...you'll find a supplier for it fast

Coming to you in the January 23, 1961 issue of American Machinist/Metalworking Manufacturing is metalworking's biggest, most comprehensive source of buying data: *the 1961 Buyers' Guide Issue.*

Whatever you need, the well-organized, easy-to-use Buyers' Guide Issue will enable you to find a buying source in a matter of minutes. With sections color-coded on special paper, with a wide range of buying information, a quick inspection of the Buyers' Guide Issue will earn it a permanent place on your desk for the whole year.

Here are the four major sections of the Buyers' Guide Issue that will go to work for you:

- **The Buyers' Guide Section** a record-sized portion of the issue that includes 39,500 listings, products of 4,500 manufacturers shown under 1,900 separate headings. The section provides sources for everything you can possibly need in metalworking manufacturing – complete with maker's name and complete address.
- **The Equipment Review Section** clear-cut, fast-reading descriptions of 1960's new products in metalworking that were reported in AM/MM's 26 issues during the year (and including the new equipment unveiled at the gigantic Chicago Exposition). For ease of use, this section is divided by manufacturing technique ("Machining," "Tooling," etc.).
- **The Metals Distributor Section** really two sections within one—to give you local sources for steel and non-ferrous metals with each warehouse shown with types stocked. Here's a handy buying reference that you'll find nowhere except in AM/MM's Buyers' Guide Issue.
- **The Machine Tool Distributor Section** where-to-buy and who-to-call data on local distributors of machine tools in principal cities shown both alphabetically and by machine tool builder represented. This section enables you to make immediate contact with the builder's local representative – a big time saver.

Advertising in the 1961 Buyers' Guide Issue will be placed (at the direction of advertisers) adjoining specific sections of the publication where it will have the greatest interest...tooling with tooling, inspection equipment with inspection equipment, etc. If more data is required, a jumbo-sized reader-service card will bring you even more information.

Metalworking's biggest, most complete source of buying data

THE BUYERS' GUIDE ISSUE

American Machinist / *Metalworking Manufacturing*

Look for it on January 23, 1961

DEPENDABLE . . . predictable response to heat treatment every time

Send for Bulletin 102— "Helpful Heat-Treating Hints."

The full uniformity within each bar of Desegatized FM die steel and the consistent uniformity from lot to lot simplifies the heat treatment of your die components. Predictable hardnesses are readily attainable . . . distortion and size change are minimized . . . danger of cracking is lessened!

In free machining FM die steels, full uniformity is achieved through Latrobe's unique Desegatized process of manufacture. This process guarantees an even distribution of carbide particles, free machining alloy sulphides and other alloying elements . . . factors leading to improved machinability, greater toughness and improved wear resistance in addition to the optimum heat-treating characteristics.

Latrobe's 12% chromium FM die steels are available through district steel service centers near you. Grades include: Olympic FM (Type D-2) for long-run applications; GSN FM (Type D-3) non-deforming die steel; Cobalt Chrome FM (Type D-5) for extra resistance to galling and pickup.

Call your Latrobe representative today!

Manufactured by skilled American labor

LATROBE
Metalmasters

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BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE NEW YORK • PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO

3M Abrasives Cut Costs of Steel Utensil Finishing

Nationally famous, "Ekcoware" cooking utensils are manufactured here in the housewares division of Ekco Products, Inc., Massillon, Ohio. Prior to color buffing, these copper-clad stainless steel pans are given a final polishing.

Abrasives Ekco formerly used for this final finishing required a considerable amount of "break-in" time and caused many pan rejects.

Now, thanks to a 3M Representative's suggestion, Ekco has switched to 3M "PG" Wheels. The results have been remarkable. "PG" wheels have upped production 20%, eliminated one handling operation, reduced rejects, and produced a better finish on the pans. There's no "break-in" period either, as 3M "PG" Wheels maintain an even cut from installation to throw-away point.

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase production. Discover:

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

Send today for a free COST CHECK 5-4-5 Review Form without obligation. Put 3M's years of abrasive know-how at your disposal.

3M Coated Abrasives

SEND IN TODAY

3M COMPANY Dept. AAA-90
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Send me my free COST CHECK 5-4-5 Kit.

COST CHECK 5-4-5

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MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

"3M" AND "PG" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO

High electrical conductivity PLUS machining savings like this — with Anaconda Leaded Copper-126

MACHINING COST COMPARISON

LEADED COPPER-126 (Electrical conductivity 98% I.A.C.S.†) (Relative machinability, 80)		ELECTROLYTIC T.P. COPPER (Electrical conductivity 101% I.A.C.S.) (Relative machinability, 20)	
CLIP ASSEMBLY (including leaves)		**CLIP ASSEMBLY** (including leaves)	
Machine fill*		Hand fill	
Drill		Drill	
Tap		Tap	
hrs per 100 pcs.	4.310	hrs per 100 pcs.	10.838
BLOCK		**BLOCK**	
Cut-off		Cut-off	
Slot		Slot	
Grind		Grind	
hrs per 100 pcs.	2.641	hrs per 100 pcs.	4.622
TOTAL		**TOTAL**	
hrs per 100 pcs.	6.951	hrs per 100 pcs.	15.460

* Parts are assembled, pin drilled, and pinned on a semiautomatic machine. Machine does not operate satisfactorily with Electrolytic T.P. Copper.

† Average for annealed metal—slightly lower in hard tempers

55% SAVING in production time PLUS savings in longer tool life—cutters, 400%—drills, 33%—taps, 33%.

Scores of electrical components made by Barkelew Electric Mfg. Co., Middletown, Ohio, specialists in the manufacture and development of high-capacity switching equipment for over 50 years, require high electrical conductivity in service and considerable machining in manufacture. The figures above for a clip assembly typify the savings made possible by the use of Anaconda's high conductivity Leaded Copper-126. Other applications include pieces machined from bar stock as large as 4½" x 2". Leaded Copper-126 is available in standard mill forms. For more information, see your Anaconda representative — or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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ELECTRICAL COPPERS
Made by The American Brass Company

Melting furnace at Calumet & Hecla, Inc.—Wolverine Division, where Shell Irus Fluid 902 eliminates the danger of hydraulic line fires.

Ready... aim... NO FIRE!

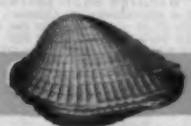
Take 10 high-temperature alloy-melting furnaces, hydraulically operated—each pouring 1500 lbs. of molten metal every hour in close proximity to "live" hydraulic lines—and you can readily see why selection of hydraulic fluids is important to Calumet & Hecla's Wolverine Tube Division.

Now the operation is made more reliable by the use of Shell Irus Fluid 902, a water-in-oil emulsion type fluid. Irus® Fluid was C & H's choice, after carefully studying other commercial hydraulic fluids—for many reasons:

1. Irus Fluid will not support combustion.
2. Irus Fluid has excellent lubricating properties.
3. Irus Fluid has hydraulic efficiency and equipment compatibility.
4. Irus Fluid is economical, costing about one-third less than other fire-resistant fluids.
5. Irus Fluid's bright yellow color makes it easy to spot and trace leaks.

In plant after plant, operators find that these advantages assure maximum safety to both personnel and equipment

If you have a hydraulic line fire hazard, we suggest that you have the Shell Industrial Products Representative show you the many advantages in Irus Fluid 902; or write to Shell Oil Company, 50 W. 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, Calif. In Canada: Shell Oil Company of Canada, Ltd., 505 University Ave., Toronto 2, Ontario.

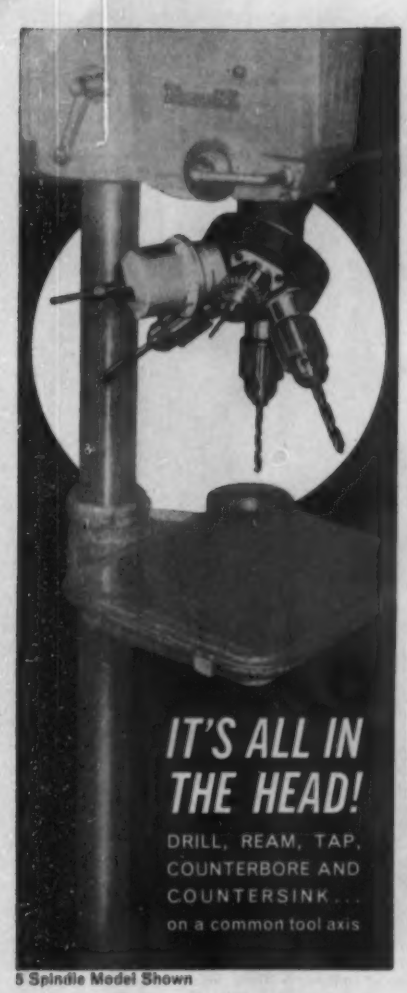


AN INTERESTING FACT!
Every Shell Branded Industrial Lubricant is named for a sea shell. Shown here is the **Irus** elliptious.

SHELL IRUS FLUID 902

the low-cost, fire-resistant hydraulic fluid

SHELL



5 Spindle Model Shown

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4 & 5 SPINDLE
TURRET DRILLING HEADS

- **Save up to 70% in direct labor costs!**
- Fast manual indexing
- Quadrill Turret Heads make it possible for **one** drill press to do the work of 4 or 5 single spindle drills, with a corresponding saving in floor space . . . save up to 350% in capital equipment costs!
- Ideal for both long and short runs . . . fast setups . . . simple tooling. On long runs, savings in direct labor quickly returns cost of turret head.
- Models available for all standard drill presses.

Quadrill Turret Drilling Heads are proven in industry throughout the world for over 15 years . . . in companies such as Westinghouse, Chrysler, Bendix, General Electric, Douglas Aviation, Boeing and many others.

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How to estimate the time element in any machining job

Use this manual to make the winning but safe bids that mean more jobs and better profits for your shop.

Machine Shop Estimating
Second Edition
BY W. A. NORDHOFF
Douglas Aircraft Company, Inc.
544 pages, 344 illus., $9.00

Here's the kind of on-the-job help you need to make quick, reliable estimates of the time it takes to do the different machining operations in any machine shop, large or small. Whether a job involves drilling, boring, tapping, threading, grinding—or any of the scores of other operations—this handy manual tells you exactly what to consider in estimating job-time.

It covers every step—from setting up a job to tearing it down—giving the specific time value established for each element. The various non-machining operations which enter into the cost of any job are also given. Instructions are provided for the use of several methods of estimating particular jobs on each type of machine in use today.

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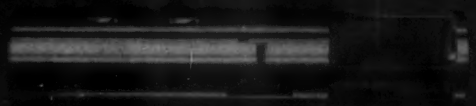

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KERNS SCF-3207

SOLUBLE CUTTING FLUID

used on 35 screw machines

at

SKF

Versatile Kerns SCF-3207 is used as both a lubricant and coolant on 35 automatic screw machines at SKF Industries, Inc. Famous SKF quality rings, rollers and sleeves are turned out on these machines which are supplied by individual coolant systems in which the Kerns SCF-3207 solution is varied with the operation.

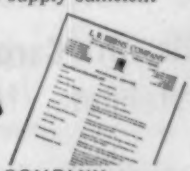
RESEACHED 11 YEARS—Kerns SCF-3207 is the result of extensive research and development. It's the greatest advancement in cutting fluids in the last fifty years and is designed to replace cutting oils in up to 90% of all types of machining operations. It can do this because it is a water emulsifiable, heavy duty, cutting oil base containing high percentages of high film strength and anti-weld additives.

CUT COST AND INVENTORY—Kerns SCF-3207 is actually 25% less expensive than the lowest priced straight cutting oils and cuts inventory and warehouse requirements. Only 5 drums of Kerns SCF-3207 equals 50 or more drums of straight cutting oil.

SAFE . . . CLEAN—Absolutely no dermatitis, positively no rancidity. Can be used with absolute safety in any type of machine tool and due to lighter viscosity there is less carry off. Parts are cleaner, cooler, easier to handle.

PROVE IT TO YOURSELF—Take advantage of our Memo Billing Trial Basis Policy. We supply sufficient quantity of SCF-3207 to conduct a comprehensive production run test, no formal invoice rendered unless completely approved in production.

Write for Technical Data Sheet SCF-3207



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cuts standard, tapered keyways ¼" to 2" wide

- fast set-up—saves time and money
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- heavy-duty hydraulic circuit—assures accurate keyways
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Write for literature and don't forget to send samples.

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Mr. Julian Kerlin, Field Service Engineer for Kearney-Trecker Service Division, explains the contribution of Micro-Fog Lubrication to MILWAUKEE-MATIC reliability and ease of servicing.

Norgren Micro-Fog® Lubrication gives Kearney & Trecker greater flexibility in machine design

The new Kearney & Trecker tape-controlled MILWAUKEE-MATIC is an outstanding example of flexibility in modern machine design. In a single machine, the MILWAUKEE-MATIC performs all the operations of milling, drilling, reaming, tapping and boring that usually require several machines.

The Milwaukee-Matic is designed for maximum "chip time" and minimum set up and down time. This requires high reliability of operation and provision for rapid servicing.

This is why Kearney & Trecker engineers chose **Norgren** Micro-Fog for the lubrication system.

The Micro-Fog centralized air-borne lubrication system gives constant, reliable, metered lubrication at each bearing point. Alarm devices are connected to the control system of the machine to give warning of conditions affecting proper lubrication.

Micro-Fog is conducted to all bearing points through tubing, eliminating the need for cumbersome and costly return piping, oil filters, sumps and pumps. The result, as Kearney & Trecker found, is a wider latitude in machine design. With **Norgren** Micro-Fog, they were able to make maximum use of unitized construction in the MILWAUKEE-MATIC, providing for fast disassembly and component replacement.

This Norgren Micro-fog Lubro-Control Unit provides lubrication for the bearings on Kearney-Trecker's MILWAUKEE-MATIC, and for the slides, ways, gears and clutches in the head.

If you design machine tools which require measured, reliable lubrication of bearings, gears, slides, chains or ways, and want greater design flexibility, it will pay you to investigate Norgren Micro-Fog Lubrication. Write for detailed information, or call your nearby Norgren Representative listed in your telephone directory.

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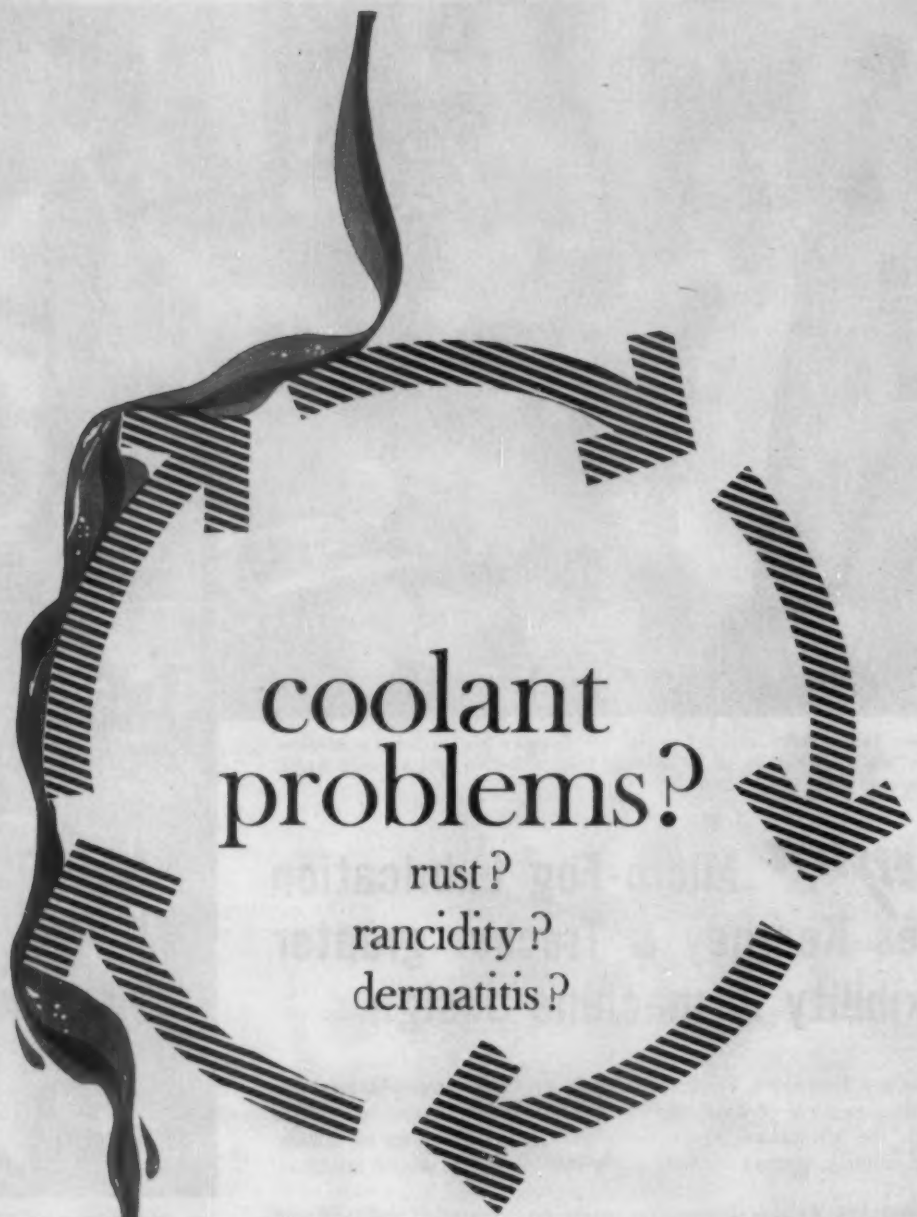

coolant problems?

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Johnson's Cold Stream stops rust—resists rancidity—reduces causes of dermatitis. These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you all the performance you pay for. **JOHNSON'S WAX**

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For information, see your local Johnson industrial distributor.

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ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

To know what's new in Barrel Finishing

Keep Your Eye on ALMCO!

The right machine, the right method, the right media . . . that's the basis for planning any ALMCO *Supersheen* System. And a continuing program of research, ever seeking even better barrel finishing . . . that's the secret of ALMCO progress in making metal finishing easier, faster and finer . . . and more profitably productive for you. Shown below are typical recent developments that give concrete meaning to the phrase, *"To know what's new in barrel finishing, keep your eye on ALMCO!"*

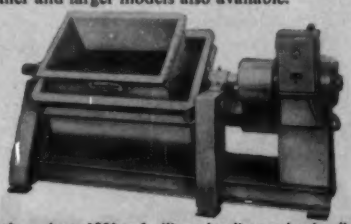
New Spindle Machine

For precision finishing of complex high-quality components such as gears, bearing cages, spline shafts, pump rotors, jet blades, etc., on a continuous production line basis. Large parts or clusters of smaller parts are chucked directly to spindles from single operator's work station. Spindles lower parts into high velocity stream of abrasive media contained in tub that rotates at controlled speed. Spindles themselves also rotate while in the abrasive stream, uniformly exposing parts to the abrasive stream. Indexing head slowly carries all spindles in 1 to 9 min. trip around the tub. All surfaces get the same amount of precision finishing.

Models available with automatic or manual indexing, 2 to 16 spindles, tub diameters of 48" to 90", and drives of 5 to 30 hp.

New ALMCO VIBRASHEEN

The new *Vibrasheen* method is particularly suited for faster burr removal from parts and finishing hard-to-reach internal crevices. This amazing metal finishing machine vibrates a full 5 cu. ft. load of parts and media . . . uses scrubbing action to remove burrs and finish parts in a fraction of the time needed in ordinary operations. Smaller and larger models also available.



Container pivots 120° to facilitate loading and unloading.

ALMCO *has the right New* BARREL FINISHING EQUIPMENT *for you!*

New ALMCO Roll Barrels

One man operates entire Roll Barrel System. Makes low-cost precision barrel finishing available to any deburring and finishing department! Ideal for finishing large variety of small lots of parts.

New Barrel Finishing Compounds

No. 407. An alkaline powdered composition used in cleaning, brightening and grinding ferrous parts.

No. 408. A very fine silica flour base powdered abrasive grinding compound for use with all metals and alloys. Provides ultra-low micro-inch finishes.

No. 410. An alkaline compound for one operation light deburring and color cycles on ferrous metals.

No. 412. A highly concentrated burnishing compound with tallow and oil soap base for use on both ferrous and non-ferrous metals.

No. 501R. A concentrated mild alkaline compound to inhibit rusting of all ferrous metals. Retains high burnishing finish.

43 other *Supersheen* compounds, plus a complete line of media, are also available from ALMCO. Ask how you can enjoy quantity discounts with the ALMCO Blanket Order Program! Start saving today!

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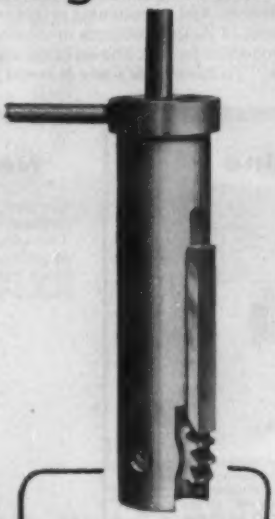
Designers and Builders of All Types of Barrel Finishing Systems for the Metal Working Industry

The INSIDE STORY about NATIONAL Keyseating Millers

NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed steel which are hardened to Rockwell specifications and accurately ground to size. Tops of teeth are staggered to break chips which reduce strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.



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complete, handy size

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It's not enough to tell you Jewel Brand Abrasive Belts are "fast cutting, cool running, and long lasting". They *are* . . . but the best way to prove *all* their advantages is on the job. Give them a "show me" run soon!

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STANDARD ZAGAR Gearless DRILL HEADS
DRILL ANY NUMBER OF HOLES IN ANY PATTERN IN ANY MATERIAL ON ALL CENTERS

Ask for Engineering Manual "A-9"

Drill a maximum number of holes in one pass—in any material. Holes can be as close as twice drill diameter. Zagar gearless drillheads are built as a complete unit or may be adapted to any standard drill press. Send us your part drawing and we will submit our quotation.

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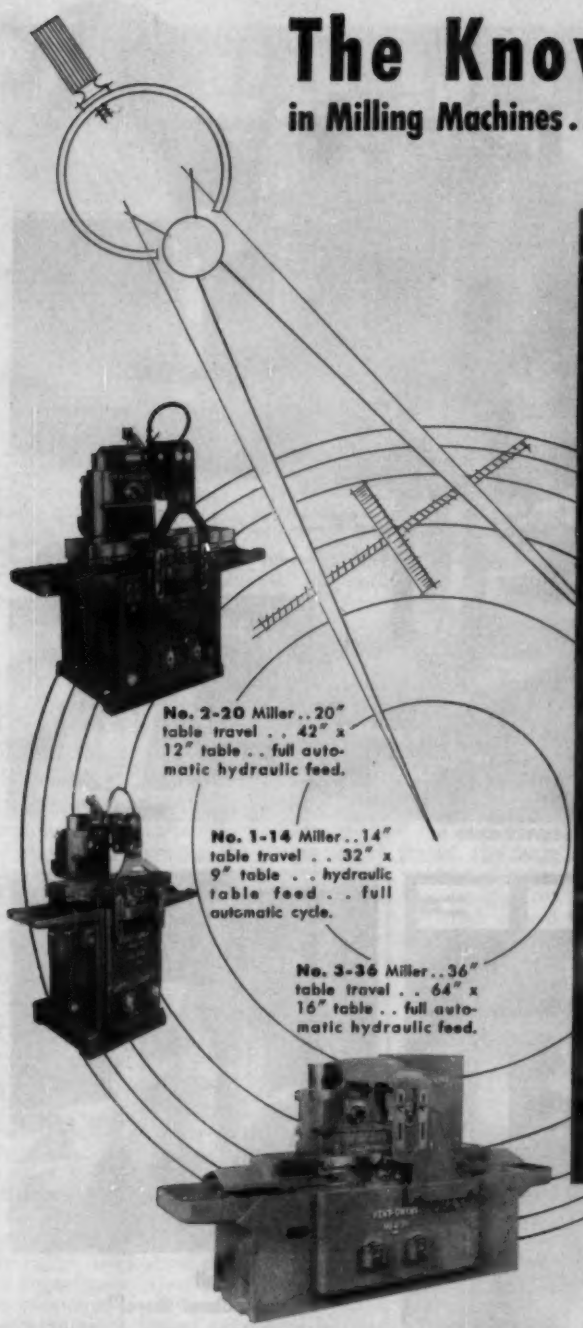
in Milling Machines . . Special Machinery . . Automation Equipment



No. 2-20 Miller . . 20" table travel . . 42" x 12" table . . full automatic hydraulic feed.

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A section of our assembly floor showing Automation-Type Machines in process of manufacture.

. . makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for *answers* to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS *Designers and Builders of Milling Machines and Special Machinery*

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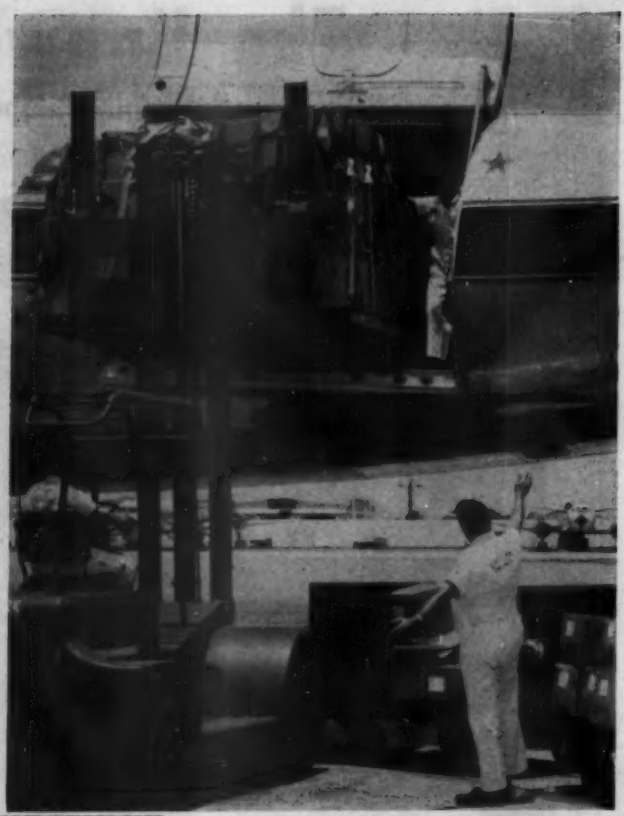

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MOLINE

No. HD68 Special

Multiple-Spindle Machine with 8" clearance between columns, drills, reams and chamfers holes in tube sheets of various sizes. Electric control provides means for determining hole pattern through selection of in-line spindles and control of two-way, positive-positioned hydraulic indexing work table.

For Greater
PRODUCTION • EFFICIENCY • SAVINGS

Use an individually designed "Hole-Hog" Machine Tool for such jobs as:

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

Over 55 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.

MOLINE TOOL CO. ROCK ISLAND, ILL.

MOLINE TOOL COMPANY
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REPRESENTATIVES IN PRINCIPAL CITIES

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"Wait'll I tell Charlie about these!"

That's how it is with Jewel Brand Abrasive Belts. One satisfied user spreads the word about their superior grinding, smoothing and polishing performance and *bingo* . . . we've gained another valued customer! They're *that* good. Try some and see.

JEWEL BRAND

COATED ABRASIVES
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ABRASIVE PRODUCTS, INC.
South Braintree 85, Massachusetts

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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 1

Subject: The Hole You're Going to Tap:

There are many things affecting successful and economical tapping but none more important than the hole you're going to tap. This is a big subject — but here are some basic points to remember which can help you.

Tapping torque and chip removal, or chip volume, in a large measure determine tap life and production costs. Major influences are:

1. The hole size before tapping
2. The hole condition before tapping

Hole Size determines Percentage of Thread

Definition: "A percentage proportion of the basic height of thread:" The smaller the hole, the greater the percentage of thread. The greater the percentage of thread, the more the tapping torque — and the greater the volume of chips. This means increased friction and temperatures which cut tap life and require slower tapping speeds. Friction caused by chips packing in the tap flutes is a severe problem, particularly in deep hole tapping. These troubles can be largely avoided by careful selection of hole size.

Excessive Percentage of Thread — not a factor in strength or quality

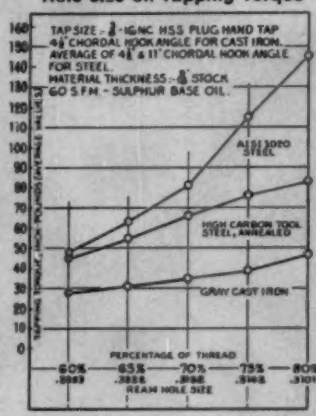
Percentage of thread specifications in Screw Threads for Federal Services Handbook H28, runs from about 53% for a No. 0-80 to about 74% on ½" diameter and larger. These percentages are adequate for the majority of work although special consideration is necessary in some cases such as stud fits.

Extensive tests show that the static strength for a length of engagement equal to a standard nut thickness reaches its maximum at 60 percent of thread. Therefore, greater percentages of thread cannot be justified on the basis of strength alone and can only be obtained at a sacrifice in tap life and efficiency.

Hole Size vs. Tapping Torque

Tapping torque increases with percentage of thread — but at a much faster rate than is generally supposed. In a recent series of torque tests it was found that in tapping AISI 1020 steel, the torque doubled when the thread percentage increased from 60% to 72% and tripled when the thread percentage was 80%. The increase was not so pronounced in annealed tool steel or cast iron, but the tests show that hole size is always a major consideration. (See fig. 1.)

Fig. 1 Effect of Hole Size on Tapping Torque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MATERIAL THICKNESS - ⅝" STOCK
60 S.F.M. - SULPHUR BASE OIL.
AISI 1020 STEEL
HIGH CARBON TOOL STEEL, ANNEALED
GRAY CAST IRON
PERCENTAGE OF THREAD
60% 65% 70% 75% 80%
REAM HOLE SIZE

The reason for these sharp increases in torque with increases in percentage of thread can be found in the volume of chip removal. On a basic thread form a 50% thread height represents the removal of only 31.25% of the basic thread area, while an increase to 75% thread height increases the area to be removed to 60.9%—or, practically double the first amount. It can be seen that even relatively small decreases in hole size can materially affect performance by increasing torque due to chip removal and disposal. (See fig. 2.)

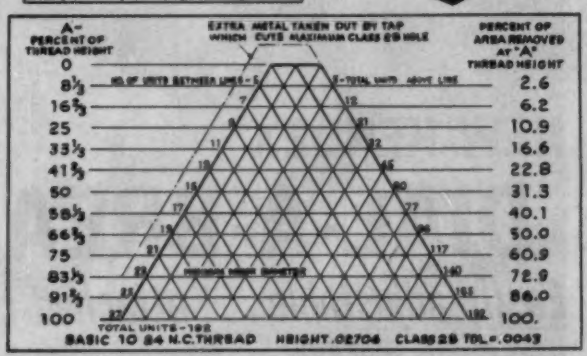

Fig. 2 Chip Volume in relation to Percentage of Thread

Hole Condition

In addition to hole size, great care should be taken so that holes will be properly prepared for tapping. The tap will have a tendency to follow the configuration and direction of the hole and if these are not reasonably accurate in relation to the tap axis and diameter, tap breakage, and holes that will not satisfy gages, will result. Conditions to be avoided are bell mouth or tapered holes, bent or crooked holes, out of round, torn or scored holes, holes with burrs, and holes with work hardened areas.

For a more detailed discussion of this subject (and particularly information on the diameter of holes which produce various percentages of threads) — fill out and mail attached coupon with 25¢ for technical brochure "Drilled Holes for Tapping" published by the Metal Cutting Tool Institute.

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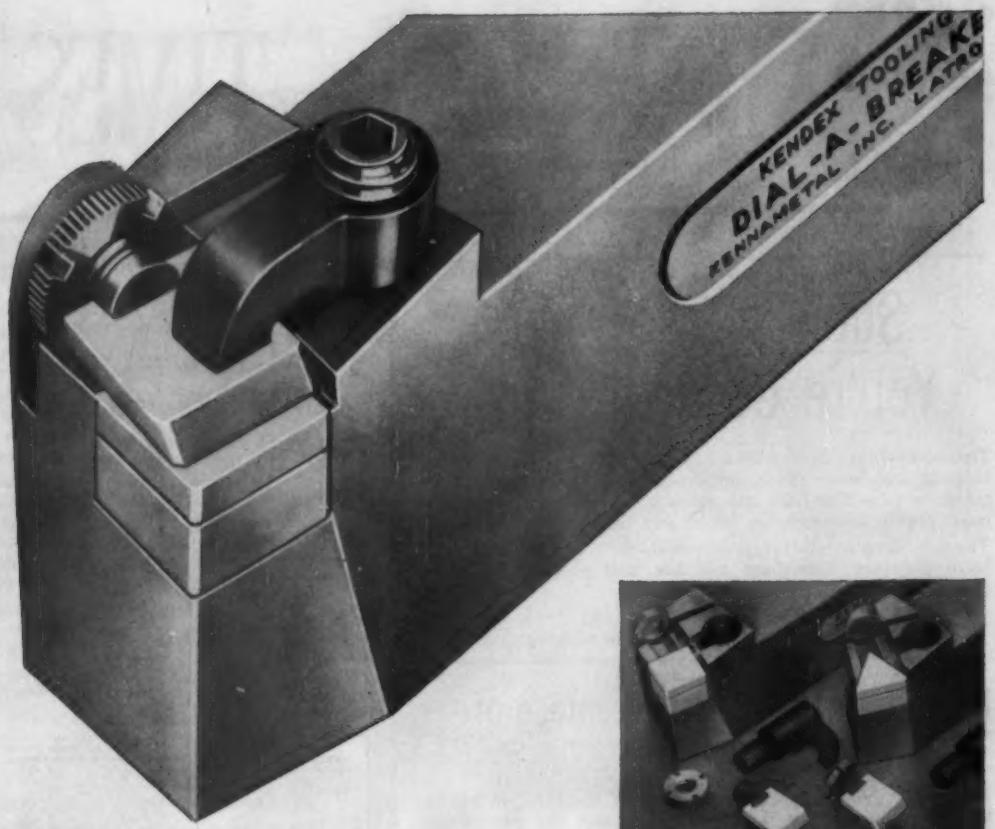

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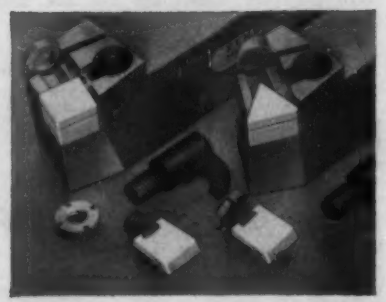
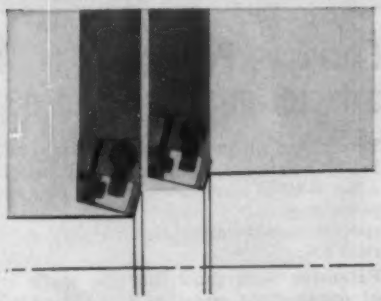


Holders illustrated with clamps and chipbreakers removed show positive seating of both triangular and square inserts. When not required, tool may be used without chipbreaker, with clamp set directly on the insert.



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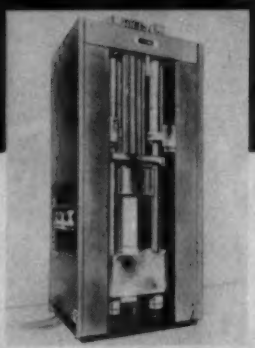

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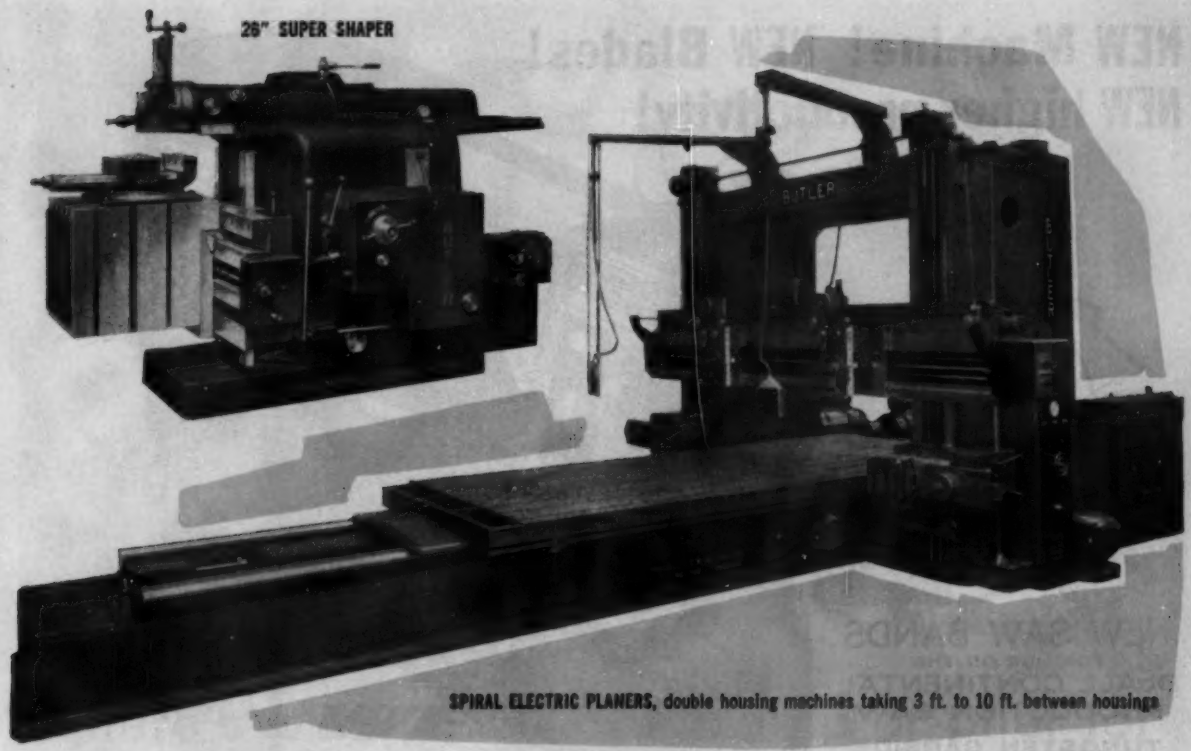

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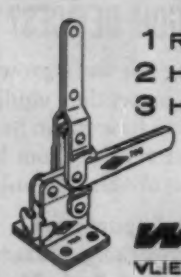

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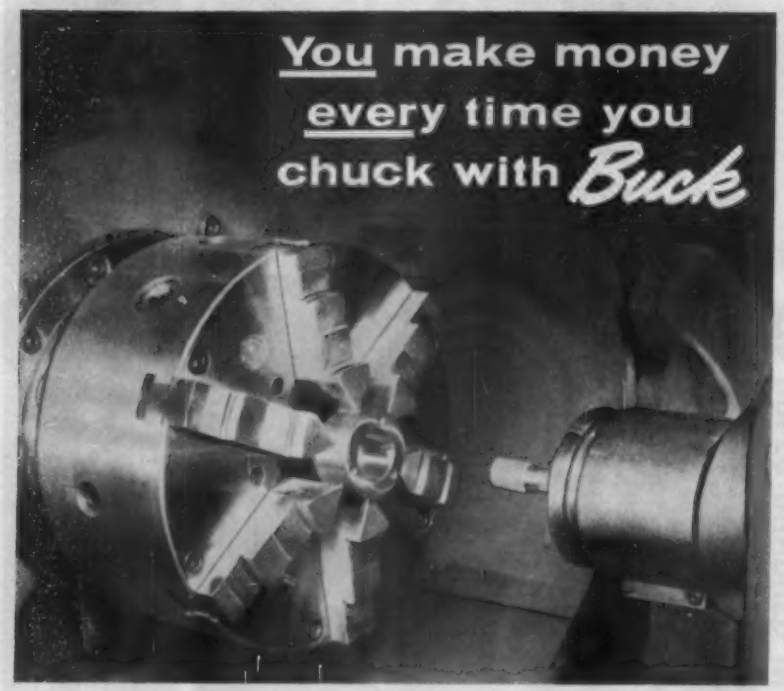

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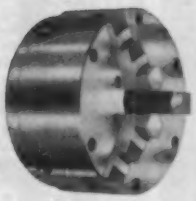

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Grinder, Style L-26-B Ex-Cell-O double end carbide
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Press, S.S., 150 ton No. 57 Toledo, tiered
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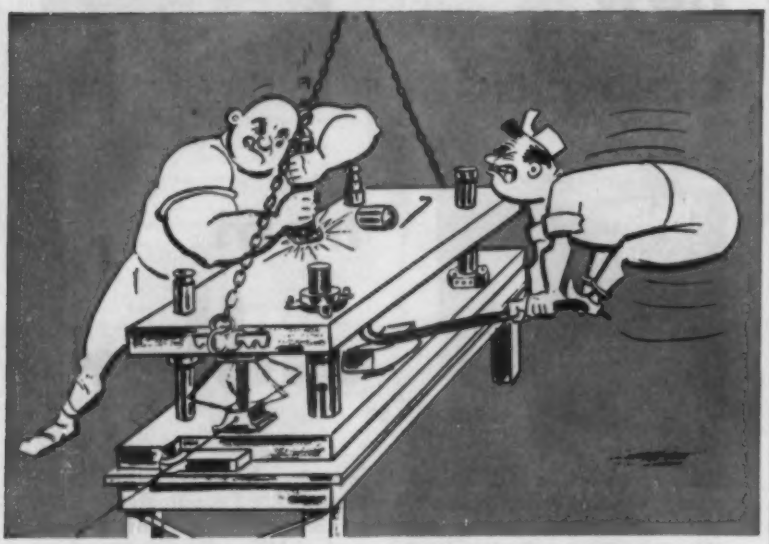

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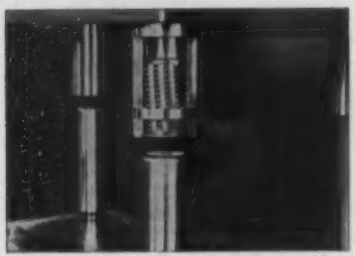

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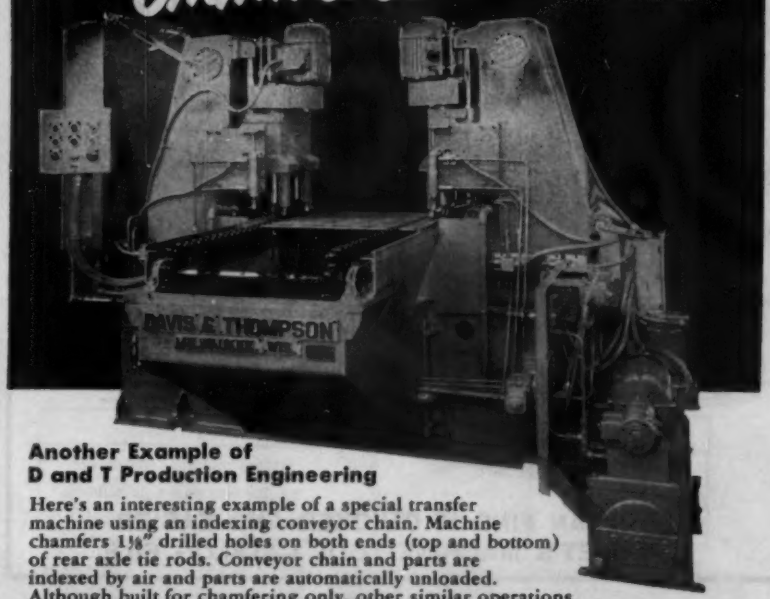

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PANTOGRAPH RATIOS

PSM 250 1:1 — 10:1

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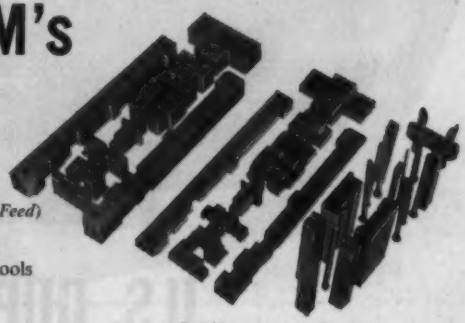
APPLICATIONS

(With Automatic Grinding Wheel Feed)

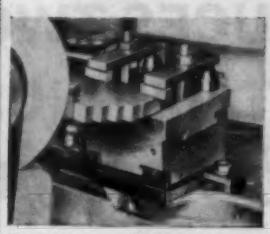
- Grinding of flat form tools
- Grinding of circular form tools
- Grinding of sectional dies
- Taper relief grinding
- Grinding of crushers or rolls between centers
- Grinding to complete 360° contours



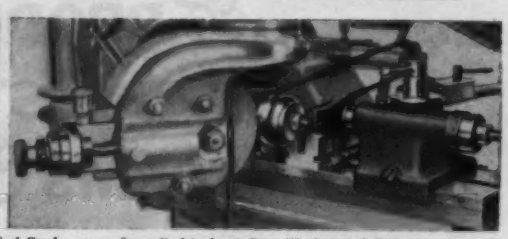
Punches and inserts of guide plate and cutting plate, with respective clamps—ground on a Studer.

ADDITIONAL SPECIFICATIONS

	PSM 250	PSM 130
Maximum template length	24"	16"
Profile length in one setting	16"	6"
Diameter of crushers or rolls	10"	4"



Profile grinding of a flat form tool.



A Studer set up for cylindrical grinding. Workpiece held between centers.

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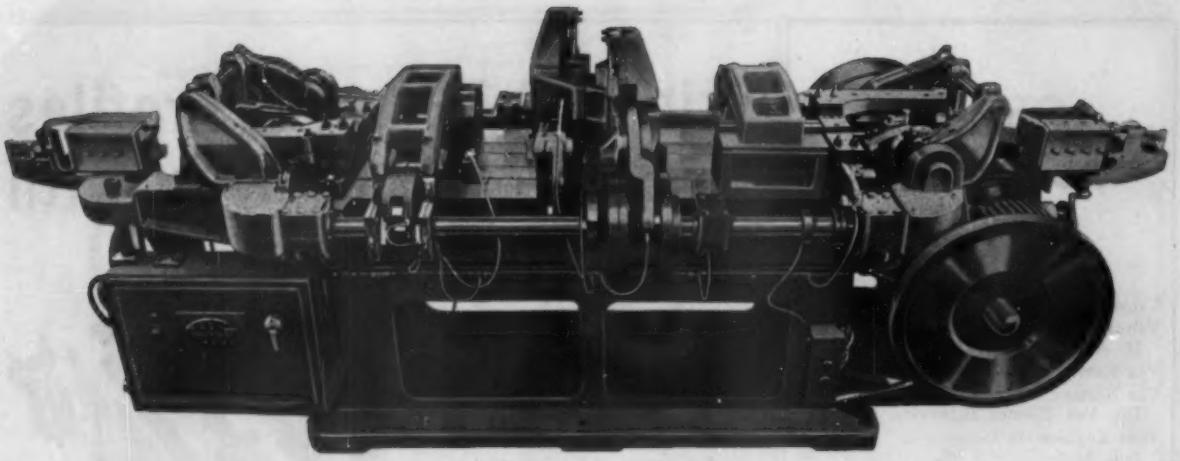

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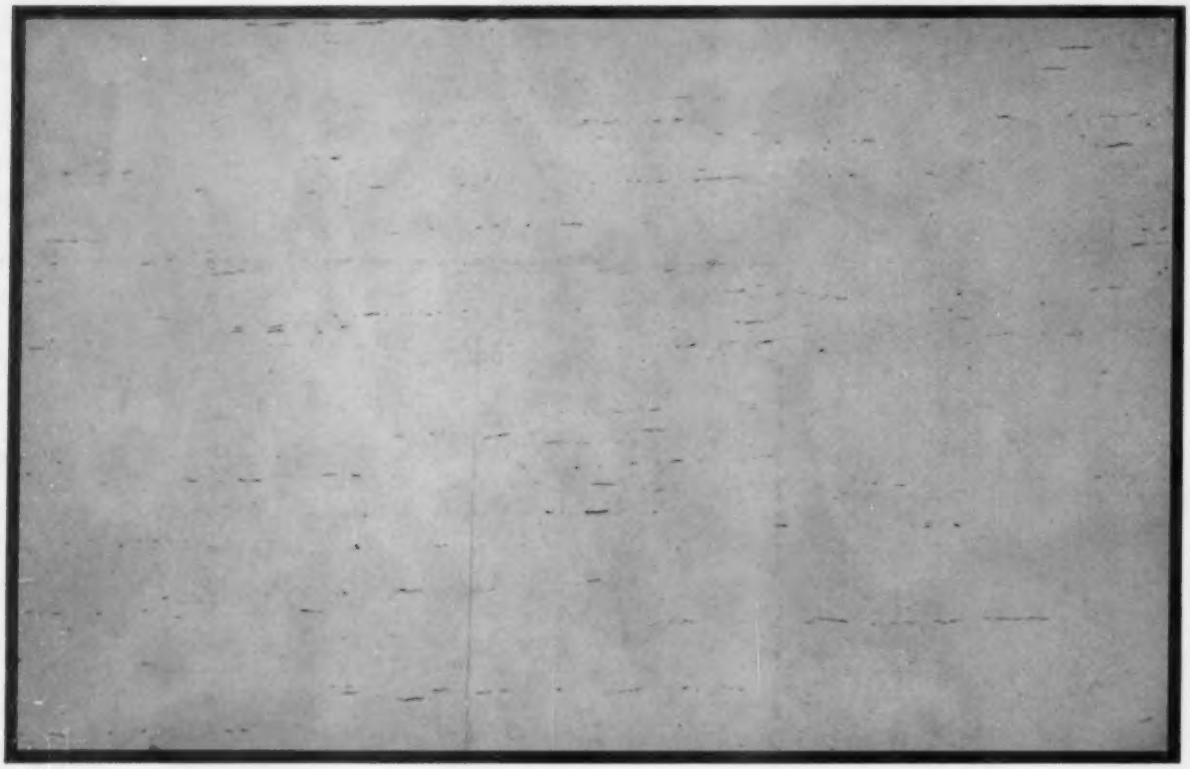

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